IBM Customer Engineering

Instruction-Reference

1415 Console — Model 1

IBM

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Preface

This manual is a major revision of the "IBM 1415 Console and I-O Printer" section of the *IBM 1410 Data Processing System Customer Engineering Manual of Instruction,* Form 225-6549. The section on "Resets" is also included. New material includes information and diagrams on the console, review questions, a CE console section, and reference material.

The study of this manual should be concurrent with the study of the 1410 system. Also refer to the following manuals:

I-O Printer (Modified IBM Selectric) CEMI, Form 225-6595

IBM Selectric Universal I-O Keyboard Printer CERM, Form 225-1726

IBM 1410-1401 Compatibility CEMI, Form 223-2597

IBM 1410 Data Processing System CE Handbook, Form 223-2588

Analysis Guide and Service Index—Selectric I-O Printer, Form 229-3114

Safety

Because of the positive action of the I-O printer, working in certain areas may be hazardous if proper safety precautions are not taken. The following rules are suggested:

1. At the completion of a service call, replace all gear guards, shields, and covers. These are installed to protect the operator from dangerous areas of the machine.

2. When lubricating, making adjustments, or working on the interior portion of the machine, be sure that power is turned off.

3. The shaded pole motor runs quite hot. Exercise caution to avoid burns.

4. Be careful when lifting and moving the printer. Watch for sharp edges on stamped parts, springs, and contacts. Avoid disturbing contacts and adjustments.

5. Before attempting any procedures or adjustments, consult the appropriate manual. Pay special attention to Danger and Caution notes.

6. Wear safety glasses whenever the outside covers are removed from the machine.

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Contents

Illustrations

The IBM 1415 Console (Figure 1) provides operator controls, CE controls, and input-output facilities for the IBM 1410 Data Processing System. The 1415 console contains the control console, indicator lights, a CE console, and the input-output printer.

Control Console

The control console contains switches, operator keys, and power keys that control the system (Figure 2).

The mode switch is set on run for normal machine operation. Five other settings of the mode switch are provided: address set, display, alter, I/E, and CE. These are covered separately under "Console Operations."

An emergency power-off switch is located on the control console. It should be used only when all power must be shut off immediately to prevent injury to an individual or damage to the machine. Pulling the switch removes all power from all the units. The switch is latched out when pulled and the control console cover must be removed to reset it.

Power keys, power lights, and the reset keys are also on the console. The power-on key lights when depressed and initiates a power-on sequence. The ready light is turned on when DC power is applied to the system. The DC off key removes DC power from the system; the power-off key removes all system power. Information on the reset keys may be found under "Resets."

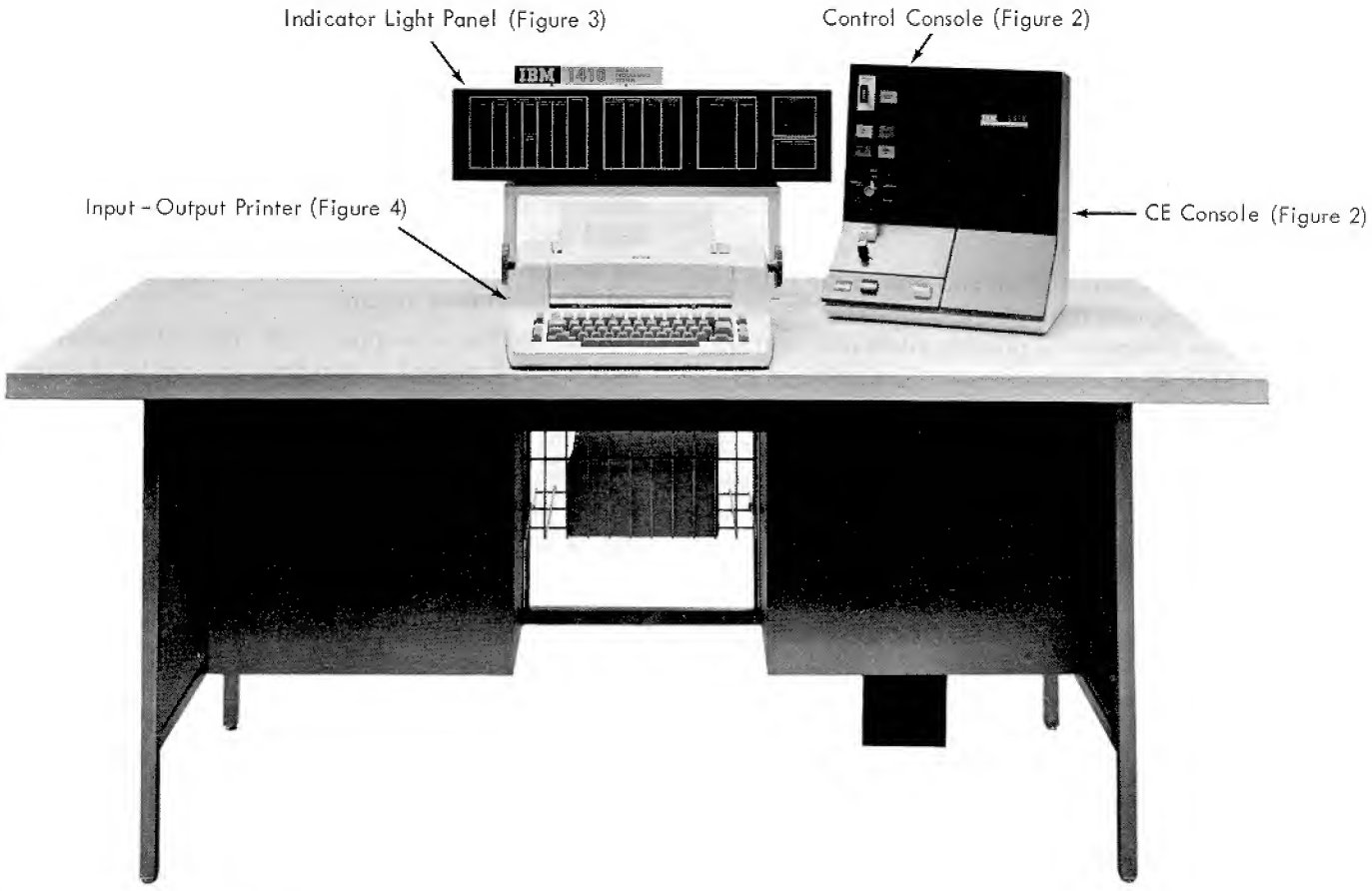


Figure 1. IBM 1415 Console

Priority process switches are included on the control console if the system has the optional "Priority Feature" installed. If the optional "Program Addressable Clock Feature" is installed, the clock and its controls will also be mounted on the control console.

Indicator Light Panel

The indicator light panel displays the status of the system to the operator. Errors, power conditions, and system controls may be directly observed (Figure 3). If the system is stopped, it is possible to note the ring position, clock position, cycle, status of the 1411, and status of the last used, I/O device. System check lights are provided to indicate error conditions. Refer to the *IBM 1410 Principles of Operation* publication, Form A22-0526, for a complete description of these lights.

CE Console

The CE console and the 1401 compatibility controls are located behind the hinged door of the control console (Figure 2). The CE console is comprised of switches used by the customer engineer when testing and servicing the system. For some operations the CE console is used by the customer. The compatibility controls are used by the customer when processing 1401 programs. Refer to the "CE Console" section for a full description of these controls.

I/O Printer

Information is received from and sent to the 1410 central processing unit through the I/O printer (Figure 4). The printer is capable of printing all 64 IBM 1410 characters; 44 of these are lower case characters and 20 are upper case characters. In addition, the printer can print an inverted circumflex (v) over any character that has a word mark associated with it. If a parity error is detected during output operations, the printer will underscore (__) the character in error.

Because it is possible to enter word marks from the printer, 128 different bit configurations can be entered into or printed out from the system. The 64 possible characters and the same 64 characters with word marks equal 128 odd-parity characters. In addition, 128 even-parity bit configurations can be printed out because of the error underscore feature.

The I/O printer performs various types of input and output operations. Figure 5 shows the printing layout and the special character that prints in position 1 to identify each type of operation.

Input Operations

During address set, display, alter, inquiry, and storage scan operations, the printer is used to enter information into the 1411. A five-digit address is keyed into the system for address set, display, and storage scan operations. Information is keyed in directly to memory during an alter or inquiry read operation.

Output Operations

Three different types of print-outs can occur on the printer; stop print-outs, displays, and programmed print-outs (console replies).

Stop Print-Out: With the inhibit print-out control switch (CE console) set to normal, a program stop, an error stop, the stop key, or any cycle stop, will initiate a stop print-out. During a stop print-out, the printer prints out the contents of the instruction address register, A address register, B address register, op register, op modifier register, A data register, B data channel, assembly channel, channel 1 unit-select register, channel 1 unit-number register, and (if two channels are on the system) channel 2 unit-select register, and channel 2 unit-number register.

If the system is stopped with the inhibit print-out switch set-off normal, a stop print-out can be obtained by setting the switch to normal and pressing the start print-out switch (CE console).

Display Print-Out: During a display operation, the printer prints out information stored in memory, starting at a previously entered address. The display is

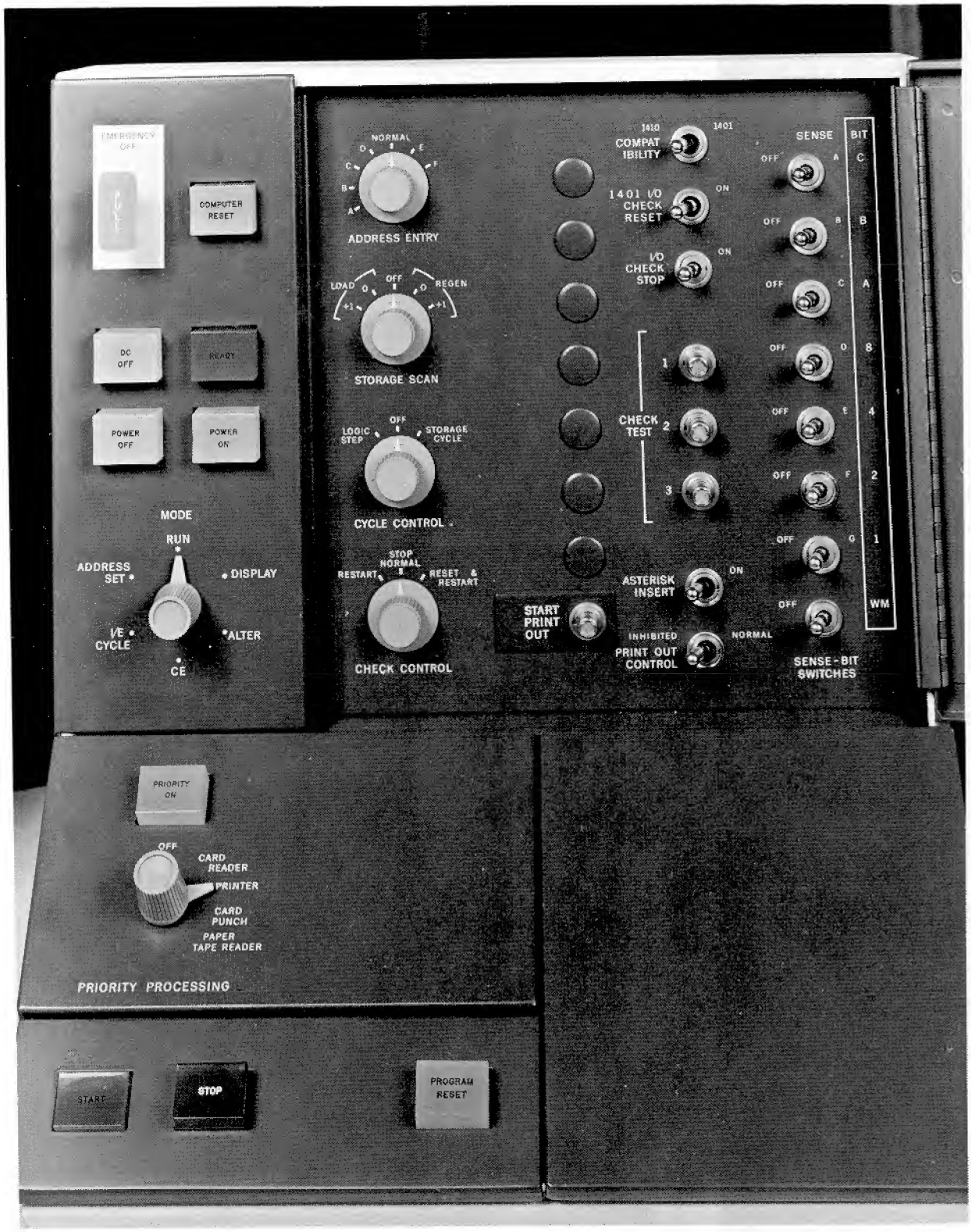


Figure 2. Control Console—CE Console

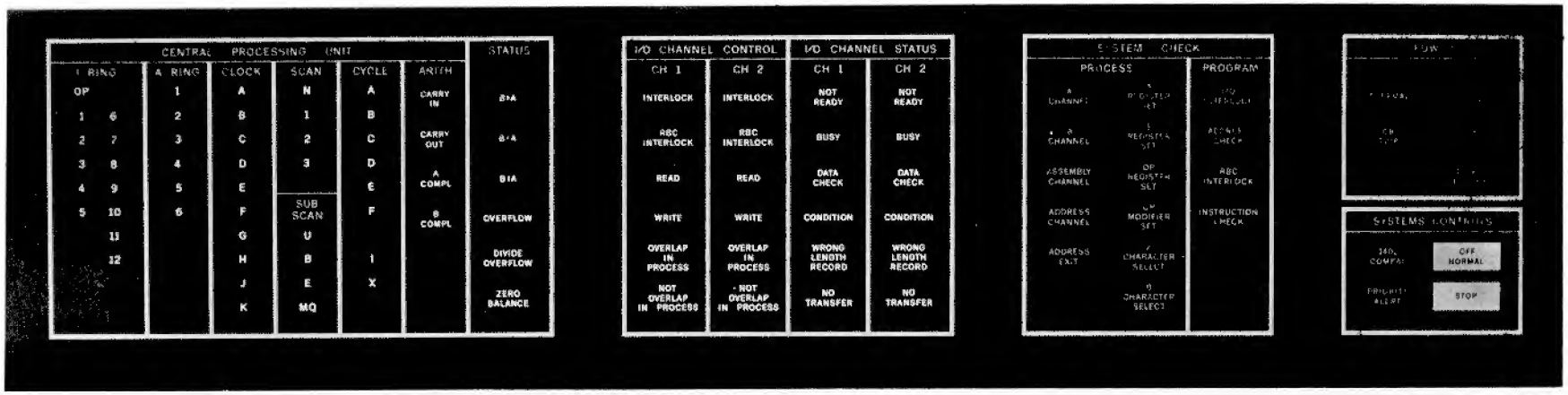


Figure 3. Indicator Light Panel

Figure 4. Input-Output Printer

Matrix Pos ID Char	Operation	Print Out Identification	IAR	AAR	BAR	Op Code Op Modifier	A Data Register B Channel Assembly Channel	Ch-1 Unit Sel Reg Unit Num Reg	Ch-2 Unit Sel Reg Unit Num Reg
35	Normal Stop	S	xxxxx	xxxxx	xxxxx	xx	xxx	xx	xx
35	Half Cycle	C	xxxxx	xxxxx	xxxxx	xx	xxx	xx	xx
35	Error Stop	E	xxxxx	xxxxx	xxxxx	xx	xxx	xx	xx
35	Program Set	B	xxxxx	Address Entry Switch - Normal					
35	Address Set	#	xxxxx	Address Entry Switch - Off Normal					
35	Stor Scan Set	#	xxxxx						
35	Display Set	D	xxxxx						
30	Display	D	xxxxxxxxx	No Definite Length					
30	Alter	A	xxxxxxxxx						
30	Console Inq	I	xxxxxxxxx						
30	Console Reply	R	xxxxxxxxx						

Figure 5. Printing Layout

terminated by pressing the stop key or is interrupted by the system recognizing a character with a word mark (in other than the first position displayed). In the latter case, the display can be continued by again pressing the start key.

Programmed Print-Out: During a programmed printout, the printer will print out from memory the information called for by the write console printer instruction M/L (%T0)(B)W. The operation is terminated when the group mark-word mark character is sensed.

The I/O printer has four types of cycles: print cycle, shift cycle, space/backspace cycle, and carrier return cycle. The keyboard is used for manual input. The select magnets are used for system output. Two basic types of operations are performed by the printer: print operations and functional operations.

Print Operations

During a print operation characters are printed on the I/O printer while being sent to or read out of the system. Character selection and printing are determined by select latches that control the position of a ball-shaped type element (Figure 6). To print each character the printer must take a print cycle.

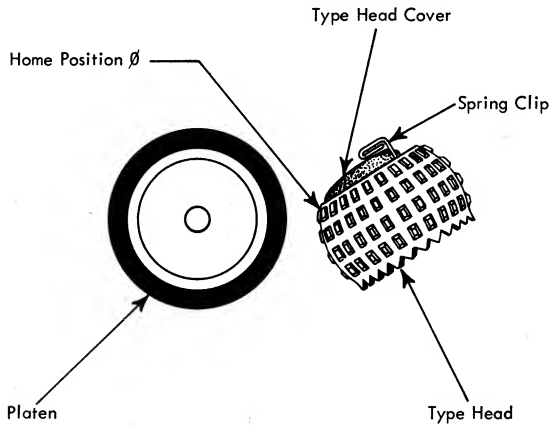


Figure 6. Type Head and Platen—Side View

Character Selection

The type element can be considered as being vertically divided into two parts called hemispheres (Figure 7). The hemispheres are designated as upper case and lower case. Each hemisphere has space for 44 characters, arranged in four horizontal rows of eleven characters each. Some positions on the upper case hemisphere are not used. The hemispheres can be identified by an arrow on top of the type element that points to the center, or home position, of the lower case hemisphere.

To print a character, the printer rotates and tilts the typehead until the desired character is in the printing position. The rotate arc is 180 degrees, covering all the characters across one hemisphere. At the beginning of each print cycle the typehead is in the home position (upper or lower case). If a shift cycle is taken, the typehead is rotated 180 degrees and the opposite hemisphere is then facing the platen.

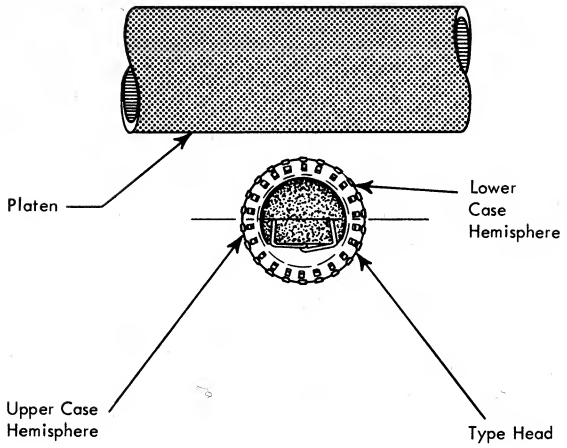


Figure 7. Type Head and Platen—Top View

Figure 8 shows the arrangement of the characters on the typehead. There are currently two typeheads available: print arrangement A for report writing and print arrangement H for program language use. Note that five characters differ in these two typeheads.

Six of the seven select latches are used for character selection: R1, R2, R2A, R5, T1, and T2. The check latch is used for internal parity checking of output characters.

Select latches R1, R2, and R2A control rotate motion of the typehead in a plus or counterclockwise (CCW) direction. The rotate motion caused by R5 is in a minus or clockwise (CW) direction. The T1 and T2 select latches control the tilt of the typehead. The rotate directions given are those seen when looking at the top of the typehead. The numeric digit associated with each select latch is the number of units of motion that will result from that latch.

All select latches, except R5, are normally in a position to be operated by the latch bail and will impart motion if a print cycle is taken. To prevent the motion resulting from R1, R2, R2A, T1, or T2, their respective magnets must be energized to select out the latches. The R5 latch is normally in a position that prevents the minus rotate motion. To obtain the R5 CW motion, the R5 magnet must be energized. The combining and eliminating of these various tilt and rotate motions result in the proper character being placed in the printing position (Figure 9). Note the following table for obtaining typehead motion.

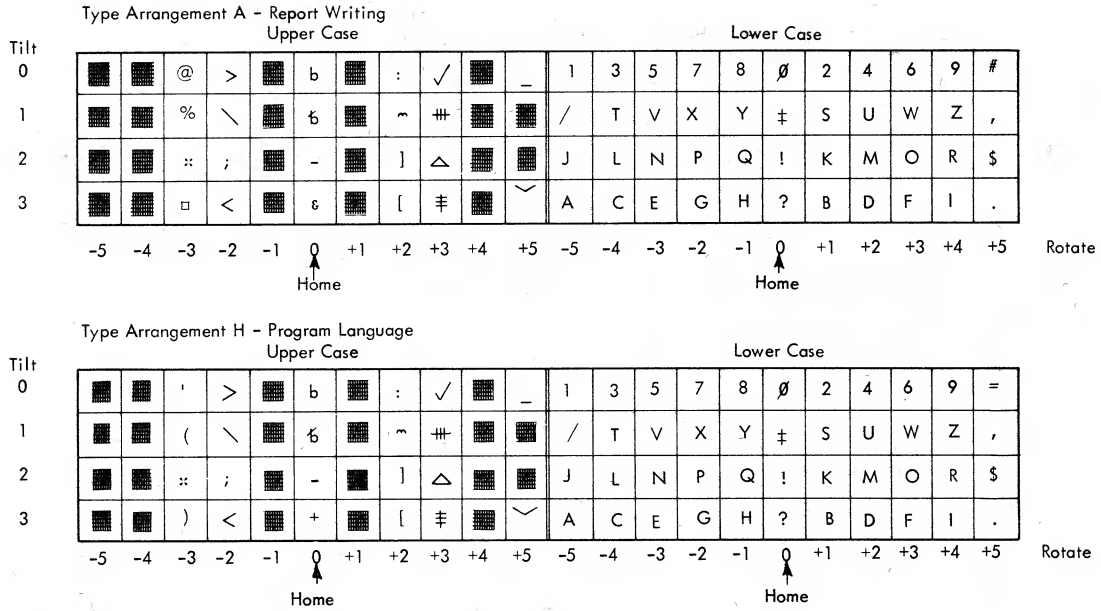


Figure 8. Standard BCD Type Elements—IBM 1415

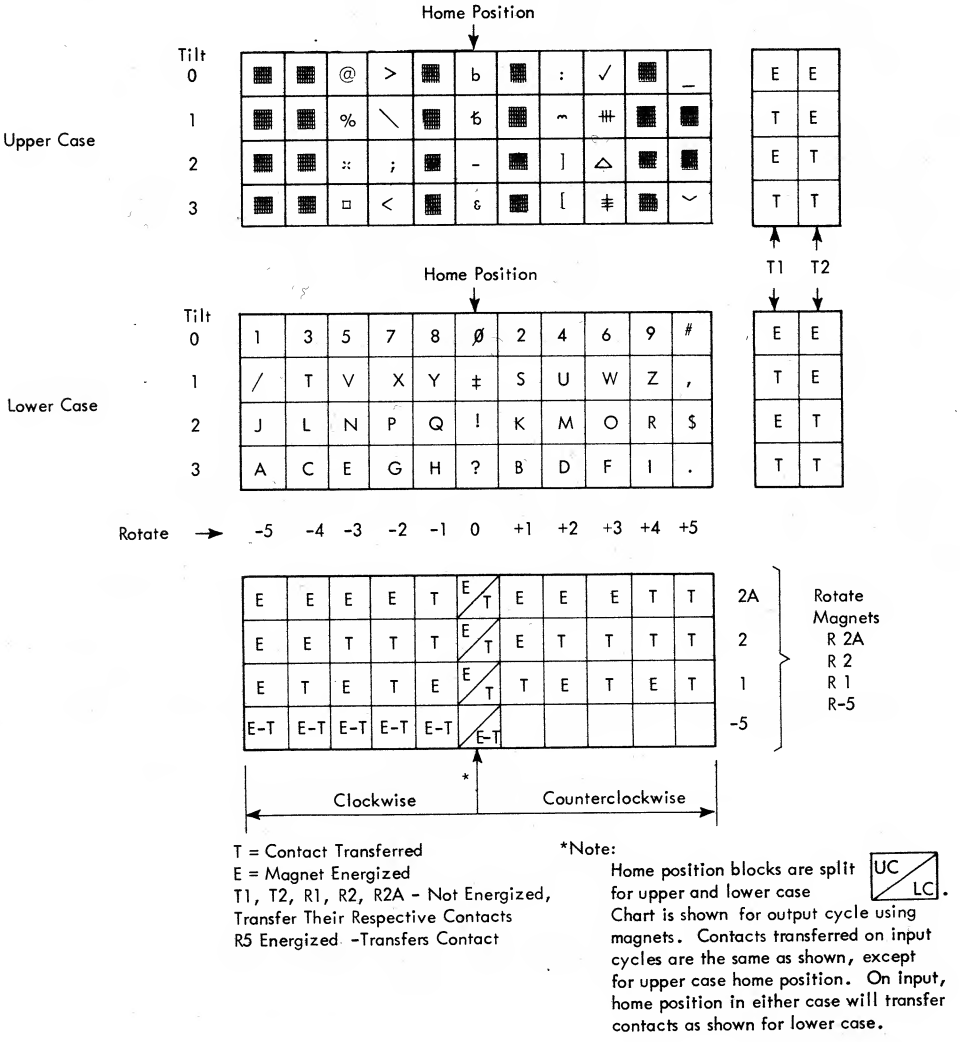


Figure 9. Select Latch Chart

Select Latch	Magnet Energized	Units of Motion	Direction
R1	No $\overline{(R1)}$	1	CCW
R2	No $\overline{(R2)}$	2	CCW
R2A	No $\overline{(R2A)}$	2	CCW
R5	Yes (R5)	5	CW
T1	No $\overline{(T1)}$	1	Tilt
T2	No $\overline{(T2)}$	2	Tilt

Home position is that position of the typehead when one of the four center characters of either hemisphere is in the printing position. Two ways of obtaining home position are called "latched home" and "1-0 home."

"Latched Home" position is a result of setting up no plus or minus rotate motion. The plus rotate R1, R2, and R2A latches are all selected out by energizing their respective magnets. The minus rotate motion is prevented by not energizing the R5 magnet. Latched home is used for all output, upper case home characters.

"1-0 home" position is a result of five units of CCW motion cancelling five units of CW motion. The R1, R2, and R2A magnets are not energized. The R5 magnet is energized. 1/0 home position is used for all output, lower case home characters and for both upper and lower case input home characters. (See note on Figure 9.)

Figure 10 shows the output translator for the printer and the 1410 system. The following examples of character selection are given using the preceding motion table and the output translator table.

BCD Bits	Magnets Picked
$\overline{2}$	R1
$\overline{8} \cdot \overline{4}$	R2
$\overline{8} + 4$	R2A
$(8 \cdot \overline{1}) + (\overline{8} \cdot 1)$	R5
$\overline{A}$	T1
$\overline{B}$	T2
$\overline{C} + (C \cdot B \cdot A \cdot 8 \cdot \overline{4} \cdot 2 \cdot 1)$*	Chk
$(\overline{8} \cdot 4 \cdot 2 \cdot \overline{1}) + (8 \cdot 4)$	UC (upper case)
All Others	LC (lower case)
∨ (Word Mark)	UC · Chk
_ (Underscore)	UC · Chk · T1 · T2

* Word Mark - Period (∨) Character
(+ = or, · = and)

Figure 10. Output Translator

1. To print a G, bit configuration: $\overline{C}$, B, A, $\overline{8}$, 4, 2, 1 (lower case)

$\overline{R1}$ = 1 unit CCW rotate
$\overline{R2}$ = 2 units CCW rotate
R2A = _____
R5 = 5 units CW rotate
} = 2 units CW rotate

$\overline{T1}$ = 1 unit tilt
$\overline{T2}$ = 2 units tilt
C = _____
} = 3 units tilt

2. To print a group mark (≢), bit configuration: C, B, A, 8, 4, 2, 1 (upper case)

$\overline{R1}$ = 1 unit CCW rotate
$\overline{R2}$ = 2 units CCW rotate
R2A = _____
$\overline{R5}$ = _____
} = 3 units CCW rotate

$\overline{T1}$ = 1 unit tilt
$\overline{T2}$ = 2 units tilt
$\overline{C}$ = parity
} = 3 units tilt

3. To print a blank (b), bit configuration: C, $\overline{B}$, $\overline{A}$, $\overline{8}$, $\overline{4}$, $\overline{2}$, $\overline{1}$ (upper case)

R1 = _____
R2 = _____
R2A = _____
$\overline{R5}$ = _____
T1 = _____
$\overline{T2}$ = _____
$\overline{C}$ = parity
} = no rotate, no tilt— (Latched Home)

If only the C select magnet is energized, a word mark (∨) or a period (.) will print depending on which case is being used. Not energizing the R1, R2, and R2A magnets will leave these latches under the latch bail and result in five units of CCW motion. The T1 and T2 latches left under the bail will result in three units of tilt. The R5 magnet is not energized; therefore the R5 latch causes no motion in a CW direction. The print cycle clutch, failing to latch, will likewise result in a word mark or a period being printed.

For characters that appear one above the other on a keyboard key, the tilt and rotate motions are the same. The printer distinguishes between the two characters on input by the use of the shift key and on output by energizing the shift magnets.

Print Cycle Contacts

Associated with each select latch are two stacked pairs of transfer contacts. The contacts for the R1, R2, R2A, T1, T2, and C latches are transferred when the latches are not selected out (magnets not energized). The contacts for the R5 latch transfer when the R5 magnet is energized and the latch is selected.

On output cycles, the top pair of latch contacts indicate the parity of the character being printed. During input cycles the bottom pair of contacts are used to transmit the keyed in information to the system. The resulting input translation can be seen in Figure 11.

Contacts Transferred	BCD Bit
$(R5 \cdot \overline{R2A} \cdot LC) + (\overline{R5} \cdot R2A) + (\overline{R5} \cdot UC)$	1
$(R1 \cdot \overline{R2A}) + (R1 \cdot LC)$	2
$R2 \cdot \overline{R2A}$	4
$(R2A \cdot LC) + (\overline{R2A} \cdot UC)$	8
T1	A
T2	B
$([Chk+Space] \cdot \overline{WM}) + (\overline{[Chk+Space]} \cdot WM)$*	C
WM	WM

* Analyzed at E1 Input - 15.60.09.
(+ = or, · = and)

Figure 11. Input Translator

The print cycle feedback contacts are called C1 and C2 and are operated by nylon cams mounted on the left end of the cycle shaft (Figure 12). The C1 contact controls the console printer strobe line. The printer strobe is used to sample the select latch contacts. The C1 contact also controls the stop latch to provide CPU cycles for display or alter operations. The C2 contact controls the termination of the select magnet pulse and also controls various console circuits in the 1411.

Print Cycle

A print cycle (Figure 13) operates in the following manner. The appropriate latches for the desired character are controlled either by key (input) or by select magnets (output). After the latches are selected, the cycle clutch engages if this is the initial print cycle. If the printer has been printing, the cycle clutch may be already engaged. The cycle clutch remains engaged as long as the cycle clutch trip lever is operated at least 5 milliseconds prior to the finish of the previous cycle.

The first point to close after the print cycle shaft begins to rotate is the normally open C2 contact. This contact signals that the drive to the magnets should be terminated. The select latch contacts are then transferred. After these contacts have transferred and settled down, the normally open C1 contact makes to bring up the console printer strobe line. The printer strobe line is used to sample the select latch contacts that are transferred. After the character prints, the select latches are mechanically restored and the normally closed C2 contact remakes, signaling that the printer is ready to set up for the next character.

Functional Operations

The functional operations performed on the I/O printer are space, backspace, word mark input, carrier return, index, and shift. These functions are driven by the operational shaft. Two operational cams are mounted on the operational shaft. The left-hand cam is a double-lobed 180 degree cam that operates the space, backspace, and word mark input operations. The right-hand cam is a single-lobed 360 degree cam that operates the indexing (line space) mechanism and the engaging of the carrier return mechanism. The shift mechanism is operated by a shift cam at the right end of the operational shaft.

The magnets and contacts associated with functional operations are shown in Figure 12. The C5 contact and the carrier return interlock (CRI) contact are feedback contacts. They perform the same control in functional cycles as the C2 contact does in a print cycle.

Space and Backspace

Pressing the space bar, or energizing the space or backspace magnets, causes the printer to take a space/backspace cycle. A backspace operation cannot be initiated from the keyboard. As the 180 degree cam begins to rotate, a pair of normally open points close to signal that a space operation is taking place (for a space operation). The transmitting contact for a backspace operation is not used in the I/O printer.

After the transmitting contacts close, the normally open C5 contact makes, to signal that the drive to the magnet should be terminated (output operation). After the operation is completed, the normally closed C5 contact remakes to signal that the printer is ready for the next cycle.

Word Mark Input

The word mark input operation uses part of the powered tab mechanism to transmit a word mark signal to the system. Because the select magnets are used for word mark output, the word mark (tab) magnet is not used. Pressing the word mark (tab) key unlatches the tab interposer, allowing the 180 degree cam to take one cycle. The word mark cycle operates the word mark transmitting contacts and the C5 feedback contacts.

A word mark input cycle does not directly cause a print operation. When the 1411 recognizes the signal from the transmitting contact, an output word mark print cycle (upper case, C magnet only) is initiated followed by a backspace cycle. The next character can then be keyed in and printed directly under the word mark.

Carrier Return and Index

The carrier return and index (line space) functions always occur together in one operation initiated only by the carrier return magnet. The printer executes the line space and the typehead carrier returns to the left margin. As the cycle begins, the normally open point of the carrier return interlock (CRI) contact closes to signal that the drive to the magnet should be terminated. The interlock contact also signals that a carrier return operation is in process. No other cycle, except a shift cycle, may be started until the carrier return operation is completed and the carrier return interlock contact returns to normal.

Shift

The shift mechanism determines the proper hemisphere for character selection. A shift cycle may be initiated from the shift key or from the system through the shift magnets. If the printer is in an output operation, the output translator examines the character to be printed, and compares it with the case of the printer. If a shift is required, either the upper case magnet or the lower case magnet is energized.

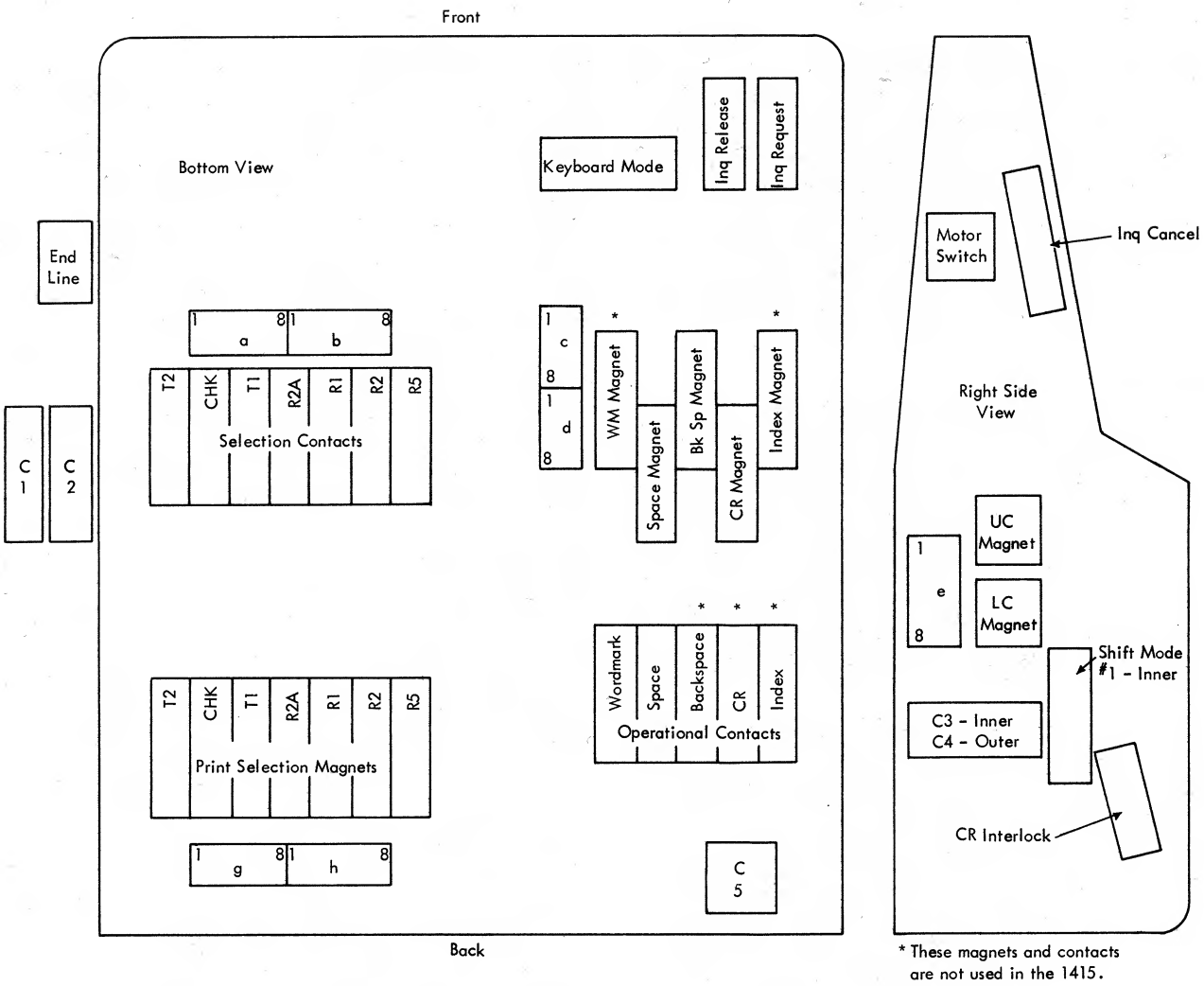


Figure 12. Printer Contact and Magnet Locations

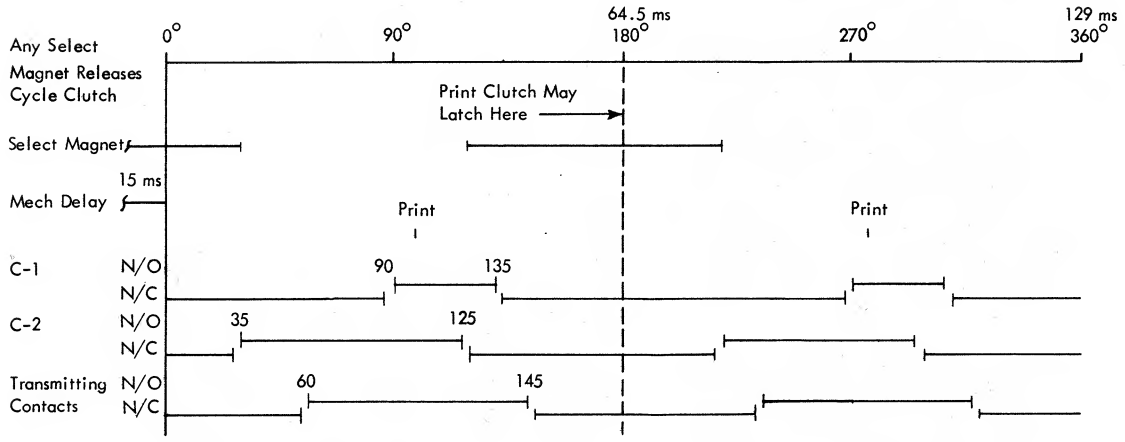


Figure 13. Print Cycle Timing

For an input operation, the printer will shift to, and stay in upper case as long as the shift key is held depressed or locked. The printer will shift back to lower case when the shift key is released or unlocked. During an output operation, the printer will remain in either upper or lower case until a shift is required. A shift operation can occur with a backspace operation but not simultaneously with a print cycle.

Associated with the shift operation are a pair of mode contacts and a pair of feedback contacts. The mode contacts are operated by the shift arm and identify whether the printer is in upper or lower case. The feedback contacts are called C3 and C4 and are transferred only during the shift cycle. These contacts do not remain transferred but return to normal at the end of the shift cycle. They may be considered as cam contacts for this reason. The C3 contact transfers while shifting from lower to upper case. The C4 contact transfers while shifting from upper to lower case. The C3 and C4 contacts signal the system when a correct shift is completed.

Inquiry and Typewriter Controls

Inquiry

Three keys are provided for inquiry control: inquiry request, inquiry release, and inquiry cancel. The inquiry request key (carrier return key) closes a normally open contact that turns on the console inquiry status latch in the 1411. The inquiry release key (backspace key) closes a normally open contact that signals the end of an inquiry message. The inquiry cancel key (index key) opens a normally closed contact to signal cancellation of an inquiry.

Keyboard Lock

The keyboard lock mechanism locks all keyboard functions, except inquiry, when the printer is not set up for manual input. The keyboard is unlocked only for specific functions (address set, alter, and read console printer). The keyboard lock solenoid must be energized to unlock the keyboard. The lock solenoid mechanism also operates the keyboard lock contact. This contact signals the keyboard status, locked or unlocked, to the system.

End-of-Line

The right-hand margin stop operates the end-of-line contact and the line-lock mechanism. The end-of-line contact closes near the end of the next-to-last column print cycle. Closing this contact signals the system that the next character will be in the last column. The line lock mechanism locks all forty-four character keys after the last column print cycle so that the operator cannot continue typing. The line lock mechanism is not restored until the carrier has moved to the left.

Console print operations performed by the 1415 console are shown on the printing layout chart (Figure 5). Every console print operation begins with the print-out identification character. A cycle control matrix is used for determining the printing format. A console clock is provided to time and gate all console operations.

Console Clock

The console clock (45.10.01), which is driven by the 1411 logic gate oscillator, runs continuously and is independent of any other clock in the system. The console clock provides four 0.75 μs pulses (Figure 14) called: console clock 1 position (cc1), console clock 2 position (cc2), console clock 3 position (cc3), and console clock 4 position (cc4).

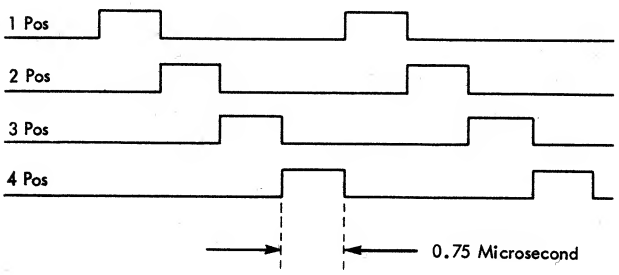


Figure 14. Console Clock

Console Cycle Control Matrix

The cycle control matrix provides gating for console operations. The matrix consists of seven X-triggers and six Y-triggers. The X-triggers are: X-1A, X-1, X-2, X-3, X-4, X-5, and X-6. The Y-triggers are: Y-1, Y-2, Y-3, Y-4, Y-5, and Y-6. The combination of one X-trigger on and one Y-trigger on, results in forty-two possible matrix positions. Each matrix position gates some particular console function (Figure 15). The matrix remains in the home position (X6-trigger on, all Y-triggers off) between console operations.

Matrix Advance

The matrix may be stepped sequentially or a selected position may be gated on. This will vary with the console operation being performed. Figure 16 shows the matrix positions required for a stop print-out operation. Matrix position 35 (MX35) is gated on for the printing of the stop print-out identification character. The matrix is then advanced to MX36 position for a space operation. MX36 position on gates MX1 to come on with the next advance pulse. The matrix then advances sequentially. The Y-triggers advance from Y-1 through Y-6 for each X-trigger position. At MX29 position, the last character is printed and MX34 position is gated on to initiate a carrier return operation. During an address set operation, the Y-triggers advance while the X-1A-trigger is on.

The Y-trigger advance occurs at console clock 2 position (cc2), when the console printer not busy latch is on (45.20.01). The X-trigger advance occurs at cc1 when the console printer not busy latch and the Y-6 trigger are on. Because of the speed of the matrix advance, interlocking the advance pulses during the print cycle is necessary. The advance pulses are interlocked by turning off the console printer not busy latch and keeping it off until each character print operation is completed.

Character Print Operation

A character print operation or sequence consists of the cycle or sequence of cycles necessary to print one complete character in a console print operation. The cycle in the sequence that causes the printing of the actual BCD character is called a character print cycle. The number and sequence of cycles in a character print operation will vary. An invalid character with a word mark requires a sequence of five cycles: word mark, backspace, character print, backspace, and error underscore. If a shift cycle is required during the sequence, it will occur simultaneously with the backspace cycle. A character with a word mark or an underscored invalid character requires three cycles. Only one cycle, a character print cycle, is needed for each valid, no word-mark character.

Print Cycle Controls

A number of latches, triggers, and lines with specific names are required for console operations. A thorough knowledge of their functions and active requirements will facilitate the understanding of these operations.

Matrix Location	Coordinates		Function	Coordinates		Address Set
1	X1	Y1	T Th Pos I AR	X1A	Y1	Type T Th Pos
2	X1	Y2	Th Pos I AR	X1A	Y2	Type Th Pos
3	X1	Y3	H Pos I AR	X1A	Y3	Type H Pos
4	X1	Y4	T Pos I AR	X1A	Y4	Type T Pos
5	X1	Y5	U Pos I AR	X1A	Y5	Type U Pos
6	X1	Y6	Space	X1A	Y6	Carrier Return (MX 6A)
7	X2	Y1	T Th Pos A AR			
8	X2	Y2	Th Pos A AR			
9	X2	Y3	H Pos A AR			
10	X2	Y4	T Pos A AR			
11	X2	Y5	U Pos A AR			
12	X2	Y6	Space			
13	X3	Y1	T Th Pos B AR			
14	X3	Y2	Th Pos B AR			
15	X3	Y3	H Pos B AR			
16	X3	Y4	T Pos B AR			
17	X3	Y5	U Pos B AR			
18	X3	Y6	Space			
19	X4	Y1	Op Register			
20	X4	Y2	Op Modifier Register			
21	X4	Y3	Space			
22	X4	Y4	A Data Register			
23	X4	Y5	B Data Channel			
24	X4	Y6	Assembly			
25	X5	Y1	Space			
26	X5	Y2	Unit Select Channel 1			
27	X5	Y3	Unit Number Channel 1			
28	X5	Y4	Unit Select Channel 2			
29	X5	Y5	Unit Number Channel 2			
30	X5	Y6	Spacial Character - D, A, I, R			
31	X6	Y1	Space			
32	X6	Y2	Rd or Wr Ops and 1st Pos of Display or Alter			
33	X6	Y3	Display or Alter-After 1st Pos			
34	X6	Y4	Carrier Return			
35	X6	Y5	Special Character - S, C, E, B, #, D			
36	X6	Y6	Space			
Home	X6	-	-			

Figure 15. Console Matrix

	Carrier Return	Printout Ident	←I A R→						←A A R→						←B A R→						Op Code	Op Modifier	A Data Reg	B Channel	Assembly Reg		Ch 1 Unit Sel Reg	Ch 1 Unit Num Reg	Ch 2 Unit Sel Reg	Ch 2 Unit Num Reg	Carrier Return
X – Position	6	6	6	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	5	5	5	5	5	6
Y – Position	-	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	4
Matrix Position	H	35	36	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	34

Figure 16. Stop Print-Out Format

Cycle Latches

Console Character Control Latch (45.50.10) is used for gating data through the output translator to the select magnets. It also controls the console printer strobe line that gates the input data. The console character control latch is normally turned on by the set first cycle latch line. When it is needed in a sequence following a backspace cycle, the cycle latch set pulse is the turn-on control. This latch is normally reset with the cycle latch reset pulse.

Console Backspace Control Latch (45.50.13) signals the printer to take a backspace cycle after printing a

word mark or a character in error. The cycle latch set pulse is the turn-on control. The cycle latch reset pulse is the turn-off control.

Console Word-Mark Control Latch (45.50.09) is used to obtain a word-mark print cycle. This latch is turned on by the cycle latch set pulse for input cycles. For output cycles the turn-on control is the set first cycle latch line. The cycle latch reset pulse is the turn-off control.

Console Error Control Latch (45.50.12) comes on in sequence after a backspace cycle to underscore the printed character when a parity error has been detected. The turn-on control is the cycle latch set pulse. The turn-off control is the cycle latch reset pulse.

Function Control Latch (45.50.14) initiates a carrier return or a space operation. The turn-on control is the take console printer cycle line. The function control latch is never turned on in the middle of a character print sequence. The cycle latch reset pulse is the turn-off control.

Start Controls

Printer Locked Condition Proceed Trigger (45.50.16) is active when the keyboard is locked—a necessary condition for normal output cycles. The trigger is turned on by transferring the keyboard lock N/O contact (lock solenoid not energized).

Take Console Printer Cycle Line (45.30.01) starts the normal output character print operation. Printer locked condition proceed trigger on, matrix not at home, and the console printer not busy latch on are the principal controls for bringing up the take console printer line which is used to develop the set first cycle latch line.

Set First Cycle Latch Line (45.50.09) turns on the console character control latch or the word mark control latch at the start of an output, character print operation. This line is made active by the take console printer cycle, not console space function and not console carrier return lines.

Control Latches

Console Printer Not Busy Latch (45.50.08) is reset on. When on, this latch signals that the printer is ready to accept a character. This latch is turned off when a character print operation is called for and cannot be latched on again until the last cycle of a character print sequence is completed. The console printer not busy latch must be on to advance the matrix or to start a character print operation. The turn-on control is the cycle latch set pulse. The turn-off control is the typewriter start latch on.

Typewriter Start Control Latch (45.50.01) conditions the cycle latch set and cycle latch reset pulses. The console check strobe trigger controls the turn-on and turn-off of this latch so that only one cycle latch set pulse and only one cycle latch reset pulse are obtained during each print cycle.

Typewriter Start Latch (45.50.03) is a turn-on control for the solenoid driver strobe latch and turns off the console printer not busy latch. For the first cycle of each character print operation, the typewriter start latch is turned on by the take console printer cycle line. If additional cycles are required for the character print operation (word mark or underscored characters), the turn-on control will be some cycle latch, being on. The activated console check strobe trigger line is the turn-off control.

Printer Strobe Reset (45.50.02) acts as a printer strobe interlock. This latch is turned on by the console printer strobe trigger to interlock its turn-on circuit. The turn-off control is the C1 N/C contact when it remakes at 135 degrees.

Strobes

Solenoid Driver Strobe Latch (45.50.03) provides gating for energizing the select and function control magnets. This latch comes on for each cycle of a character print sequence. The turn-on control is the typewriter start latch on and the shift complete line active. The turn-off control is the console check strobe trigger in its active status.

Console Check Strobe Trigger (45.50.01) is not actually a strobe but the principal control for printer operations. The check strobe trigger controls the typewriter start control latch, the typewriter start latch, the solenoid driver strobe latch, the cycle latch set and reset pulses, the console printer strobe trigger, and the printer strobe reset latch. The status of the console check strobe trigger is determined by the printer feedback contacts. When the normally closed points of the C2, C5, and the CRI contacts are made (C2 cam N/C line), the trigger will be in its inactive status. The transferring of any one of these contacts (C2 cam N/O line) will activate the trigger line.

Console Printer Strobe Trigger (45.50.02) controls the gating of data to the system during input cycles. During output cycles, the console printer strobe trigger controls the gating of output data and the parity checking circuits. The normal turn-on controls are: printer strobe reset latch off, console character control latch on, console check strobe trigger active, and the C1 N/O contact made (90 degrees).

This section covers the operations performed by the 1415 console. Since the print cycle is involved in a majority of these operations, a basic print cycle will be discussed first. The I/O read and write console printer instructions are covered in this section under "Inquiry."

Basic output data flow is shown in Figure 17. The input data flow from the printer to E1 input is shown in Figure 18.

Basic Print Cycle

One-half revolution of the cycle shaft constitutes one complete print cycle which results in the printing of one typehead character. A print cycle will cover either a 0 to 180 degree or 180 to 0 degree rotation of the cycle shaft. In this manual all timing references will be made to the 0 to 180 degree cycle.

Output

The simplest output cycle that can occur on the printer is the printing of a lower case, valid character. Figure 19 is a timing chart showing this operation taking place in the middle of continuous output cycles with no shifts required. Figure 20 is a second level diagram of this basic output cycle. At 125 degrees, when the C2 N/C contact remakes, the print cycle is electrically finished. The output cycle timing chart, Figure 19, begins at this point. The setup for the next output print cycle takes place during this last portion of the print cycle.

When the C2 N/C contact remakes at 125 degrees, the console check strobe line is deactivated at cc3. One clock pulse later, at cc4, the cycle latch set line is brought up and turns on the console printer not busy latch. The console character control latch, on from the previous cycle, is then reset at cc1 with the cycle latch reset line. The console printer not busy latch on, conditions an AND circuit (3E, 2D, 2E—45.30.01) to develop the take console printer cycle line. This line, at the next cc3, brings up the set first cycle latch line to turn on the console character control latch again. Prior to this, the deactivated console check strobe line turned on the type start control latch at cc2. The type start control latch on, take console printer cycle line up, and the solenoid driver strobe latch off turn on the type start latch on cc3. The type start latch, at the next cc1, controls the turn-on of the solenoid driver strobe latch if the shift complete line is up. The solenoid driver strobe latch on and the console character control latch on gate the console assembly bits through the translator to energize the select magnets.

The energization of the select magnets causes selection of the proper tilt and rotate latches and operates the cycle clutch trip lever to prevent the cycle clutch from latching (continuous cycles). The new print cycle

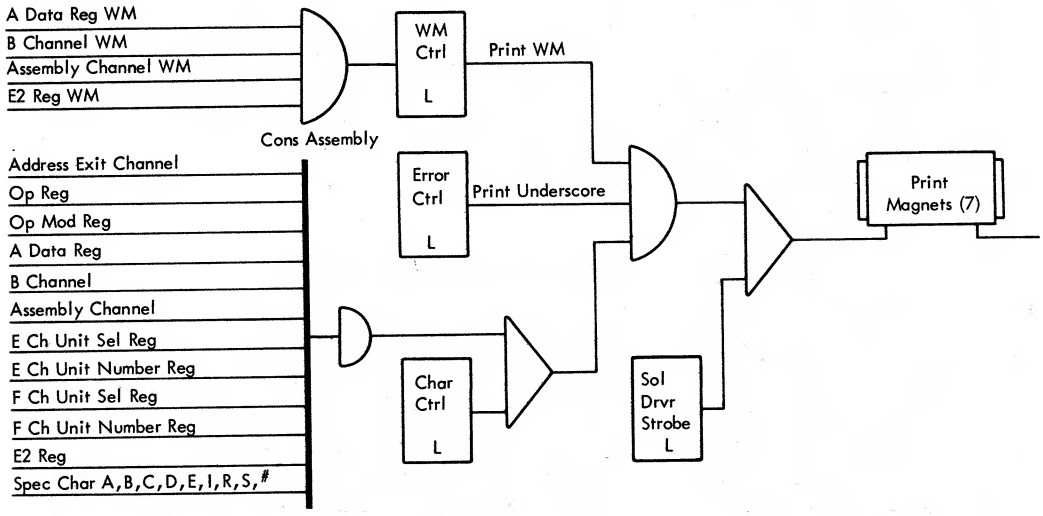


Figure 17. 1415 Console—Output Data Flow

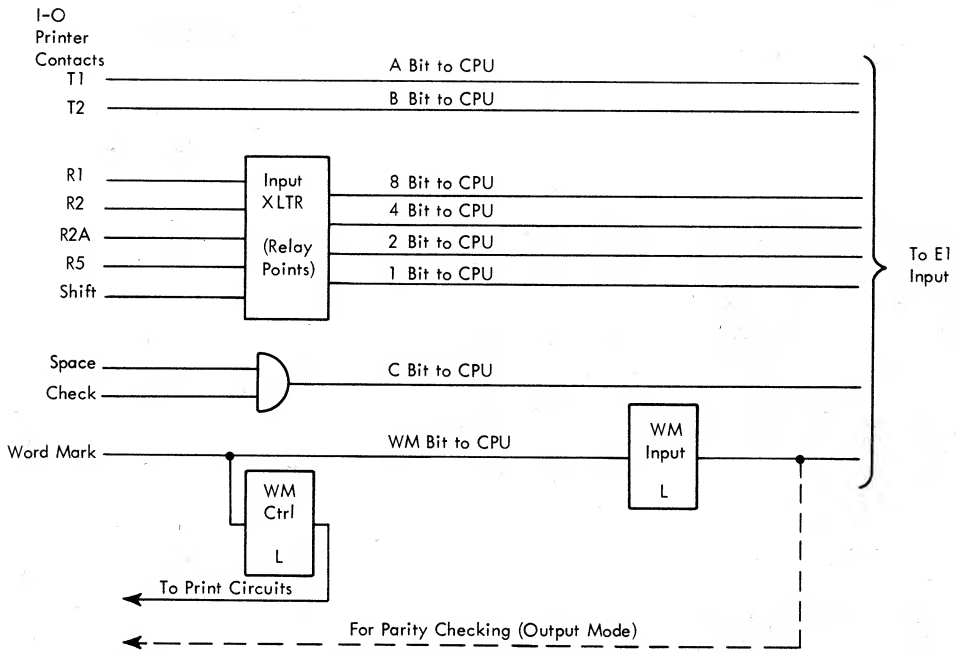


Figure 18. 1415 Console—Input Data Lines

begins at 0 degrees. At 35 degrees, when the C2 N/O contact makes, the console check strobe line is activated with a cc3 pulse. This line resets the type start latch and also resets the solenoid driver strobe latch to de-energize the select magnets. At cc1, the console check strobe line also resets the type start control latch. The mechanical action continues and at 104 degrees, the character prints on the paper. When the C2 N/C contact makes again at 125 degrees, the setup for the next character is started, as previously described.

Input

The controls for a basic input cycle are shown in Figure 21. After the print-out identification and space cycles are completed, the keyboard is unlocked with the keyboard unlock line (45.50.07). The console character control latch is turned on with the keyboard unlock set line. Pressing a character key controls the selection bails which operate the proper select latches to set up the tilt and rotate motions. The cycle bail is also operated to trip the clutch and start the print cycle. At 35 degrees of the cycle, the C2 N/O contact makes and the console check strobe is activated at cc3. (For a space input cycle, this will occur at 55 degrees when the C5 N/O contact makes.) The console character control latch on, the console check strobe line active, and the printer strobe reset latch off will turn on the console printer strobe trigger at cc1 when the C1 N/O contact makes at 90 degrees. The printer strobe trigger will remain on for only four console clock pulses since it is turned off at the next cc1 pulse and its on output turns on the printer strobe reset latch at cc3, to interlock the turn-on circuit. The console printer strobe trigger brings up the console strobe line on 45.30.02.

If the input cycle occurs during an I/O read console printer operation, the following sequence is necessary to bring up the set E1 register line. The console strobe line and the E channel select unit T line turn on the E channel strobe trigger. This trigger develops the E channel clocked strobe input line that allows the set E1 trigger to be activated at first clock pulse time. The set E1 trigger brings up the set E1 register line. The set E1 register line can also be brought up by the gate console to assembly line. If the input cycle occurs during an alter, address set, or storage scan load operation, the gate console to assembly line is developed on 15.62.08.

The data from the select latch contacts are developed on 15.60.01-06 into the E1 input lines. The set E1 register line and the E1 input lines combine on 15.60.21-28 to set the E1 registers.

Character Print Operation

Before any console operation is started, the matrix must be in home position, the keyboard locked, and the console printer not busy latch on. The type of operation gates either matrix position 30 or 35 to come on with the next matrix drive set pulse. The take console printer cycle line is brought up by: matrix not at home, printer locked condition proceed trigger on, and the console printer not busy latch on. The next cc3 pulse turns on

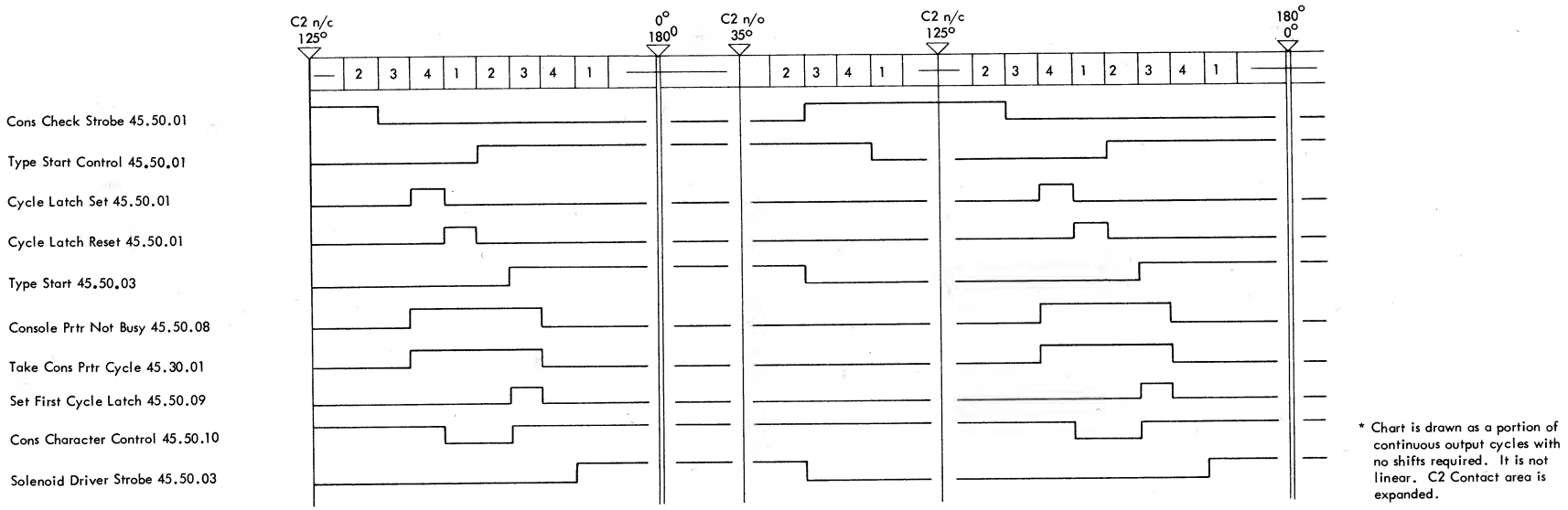


Figure 19. Output Cycle Timing Chart—Lower Case, Valid Character

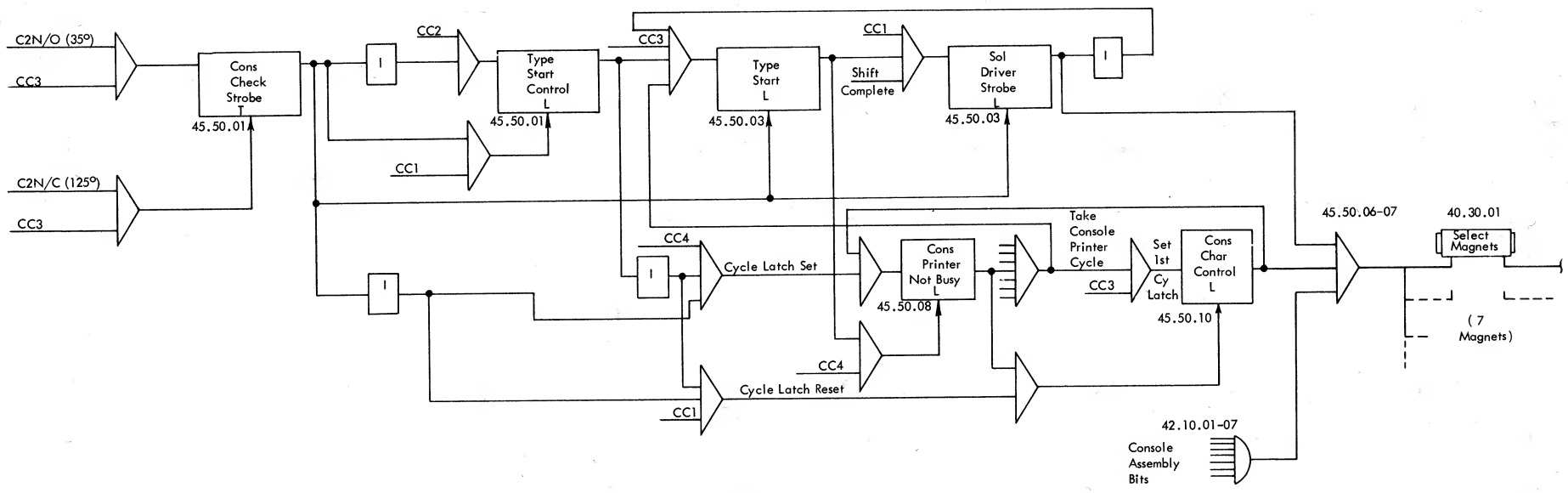


Figure 20. Basic Output Cycle

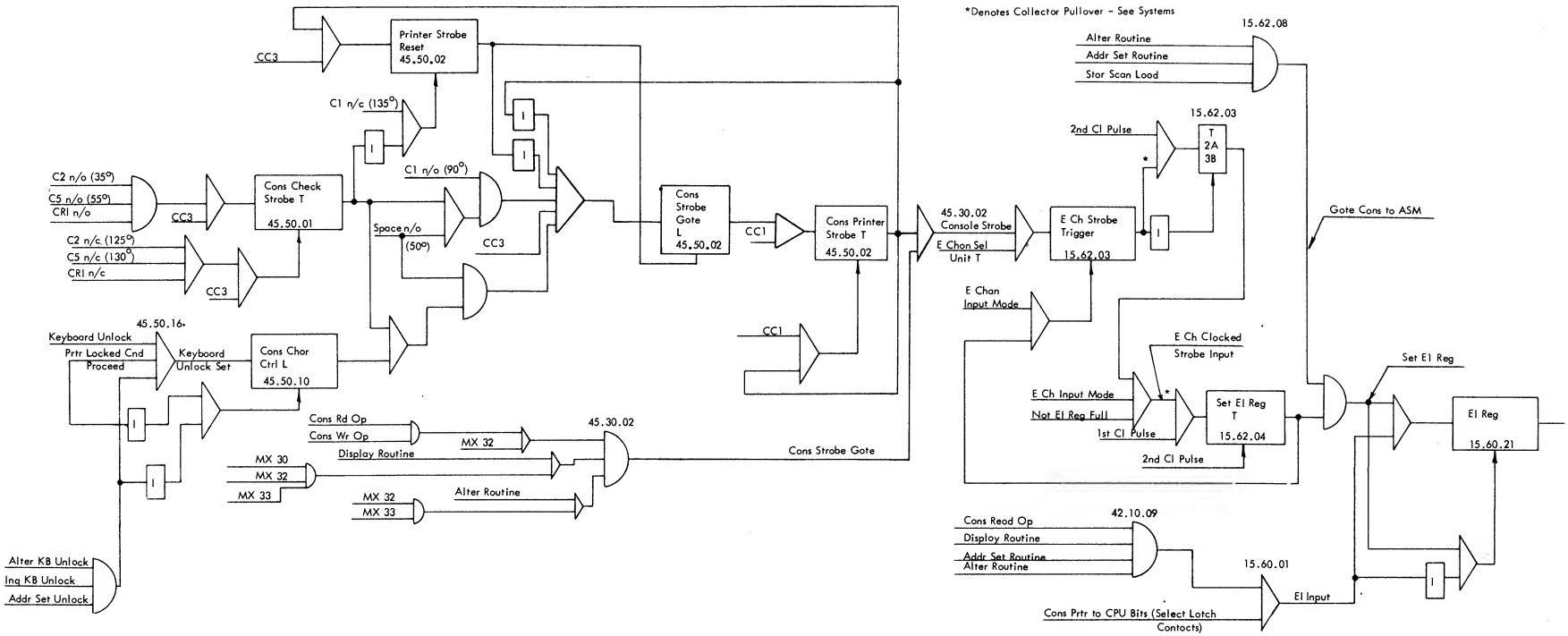


Figure 21. Basic Input Cycle

the type start latch which turns off the console printer not busy latch at CC4 to prevent the matrix from advancing. Matrix position 30 or 35 gates the proper print-out identification character to the console output bit lines, and an output character print operation (Figure 22) is performed followed by a space operation. Every console operation is started in this manner and will be followed by either output or input character print operations.

Output

An analysis of the output bit lines for each output character determines the subsequent action. If the character has a word-mark bit, the console WM control latch is turned on. If the character is a period (·) with a C bit, the WM period latch is also turned on. For characters without word marks, the console character control latch is turned on with the set first cycle latch line. This line is developed at CC3 by the take console printer cycle line (Figure 23).

The output lines are also analyzed to determine whether the character is an upper case or a lower case character (Figure 24). Any bit configuration with $\overline{8} \cdot \overline{4} \cdot \overline{2} \cdot \overline{1}$ or $8 \cdot 4$ bits indicates an upper case (UC) character. All other bit configurations indicate a lower case (LC) character. The printer shift mode contacts indicate the case, upper or lower, that the printer is in. The console character control latch on, allows the output bits to energize the proper shift magnet if a shift is necessary.

If a shift cycle is taken, the console printer shift complete line is deactivated. This line will be brought up again when the proper shift mode contact is made and the shift feedback N/O contact (C3 or C4) breaks (45.50.05). When the console printer shift complete line comes up again, the type start latch on turns on the solenoid driver strobe latch at CC1. The solenoid driver strobe and the console character control latches on, combine with the console output bit lines to energize the proper rotate, tilt, and check select magnets.

The energization of any select magnet trips the printer clutch to start the print cycle. When the C2 N/O contact makes at 35 degrees, the console check strobe trigger line is activated and turns off the solenoid driver strobe latch to de-energize the select magnets. At 90 degrees, when the C1 N/O contact makes, the console check strobe line active and the console character control latch on, combine at CC1 to turn on the console printer strobe trigger. This trigger samples the select latch contact network. If the number of contacts transferred is even, there should be a word mark. If the number of contacts transferred is odd, there should not be a word mark. If these conditions are not satisfied, the console printer strobe trigger line turns on the console output error latch to initiate an error routine (backspace and underscore).

When the C2 N/C contact remakes at 125 degrees, the console check strobe trigger line is deactivated and at the next CC4 pulse brings up the cycle latch set pulse. If the output error, WM control, and backspace control latches are all off (indicating no other sequence cycles are required), the cycle latch set pulse will turn on the console printer not busy latch. The next CC1 pulse brings up the cycle latch reset pulse to turn off the console character control latch. With the console printer not busy latch on, the matrix can be advanced (if needed) and the next character print sequence can be started (1 on Figure 22).

If a word-mark bit is detected at the output bit lines, a word-mark routine will be initiated (see "Word-Mark Control"). The word-mark routine causes a three-cycle character print sequence: a word-mark cycle, a backspace cycle, and a character print cycle.

A special procedure is followed when the period (·) character with a word mark appears on the output lines. When a period ($\overline{WM}$, $\overline{C}$, B, A, 8, $\overline{4}$, 2, 1) is printed, the check magnet is the only select magnet energized and it controls the tripping of the cycle clutch. When an output period with a word mark (WM, C, B, A, 8, $\overline{4}$, 2, 1) is to be printed, the C bit present would normally prevent energizing the check magnet. Since at least one select magnet must be energized to operate the cycle clutch trip lever, this bit configuration will force the check magnet to be energized (45.50.07) and will turn on the WM period latch (45.50.11). This latch on prevents the console printer strobe from turning on the console output error latch on 45.50.11 since an odd number of select latch contacts will now be transferred. An odd number of contacts transferred along with the word mark would indicate a false error condition. If there is no output WM bit and the WM period latch is on, an error should be indicated. The WM period latch on will bring up the line out of block 4F, 45.50.11, which will combine with the console WM character line down at 3F, to turn on the output error latch.

Input

Console input operations always begin with an output character print operation (identification character) followed by a space operation. The matrix controls the unlocking of the keyboard. Pressing a character key operates a selector interposer. Any operated interposer moves the cycle bail to unlatch the cycle clutch and start the print cycle.

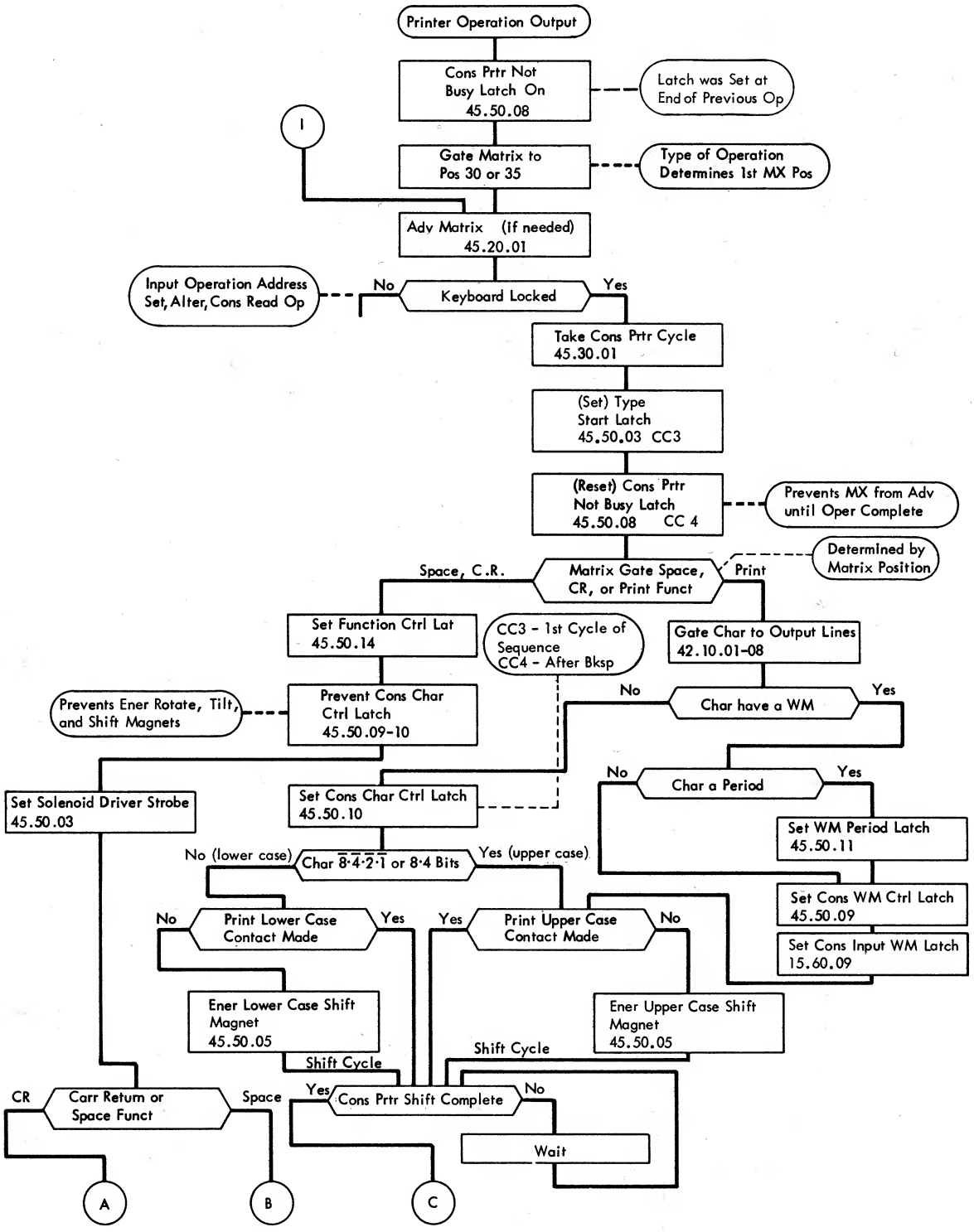


Figure 22. Printer Operation (Output) (Sheet 1 of 3)

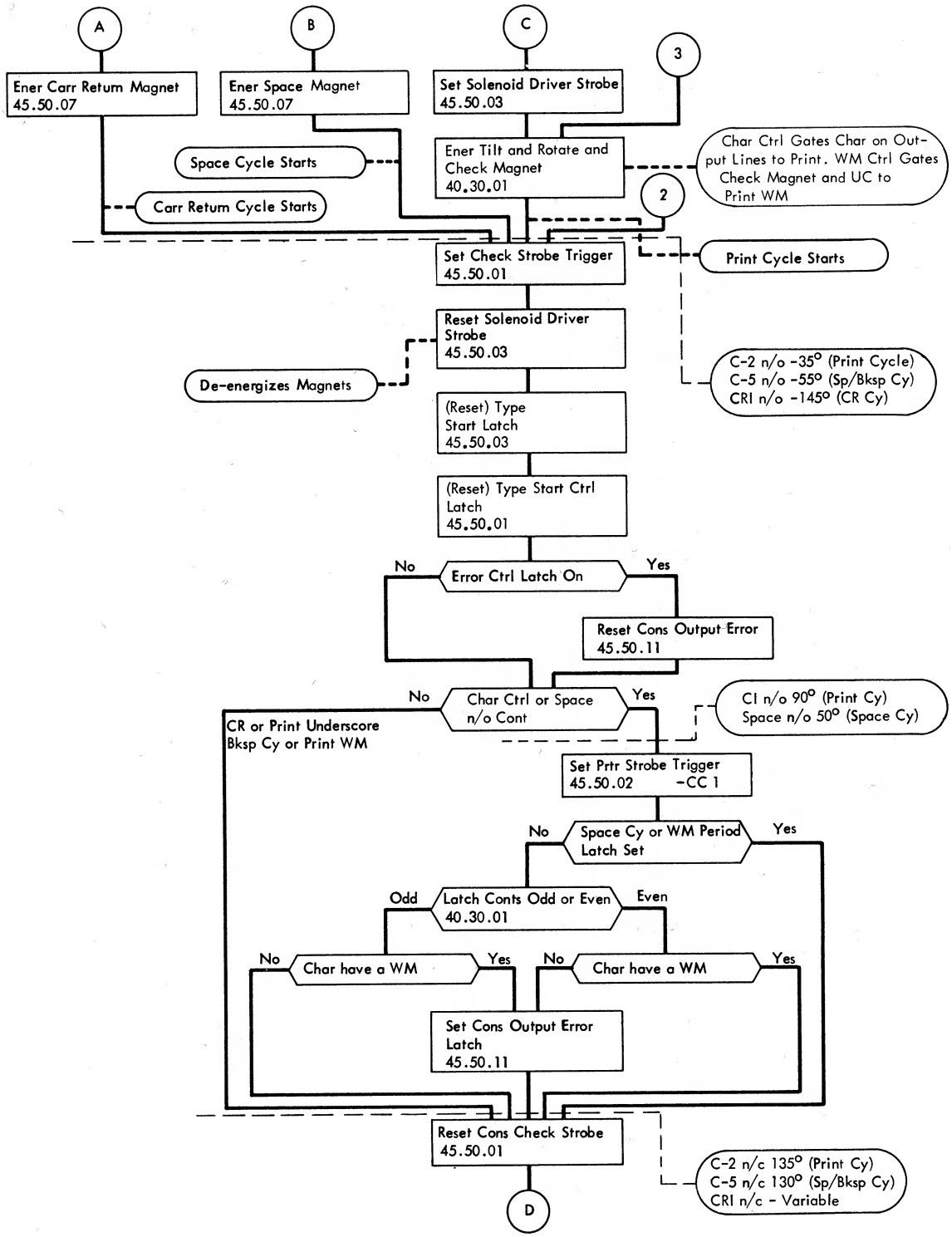


Figure 22. Printer Operation (Output) (Sheet 2 of 3)

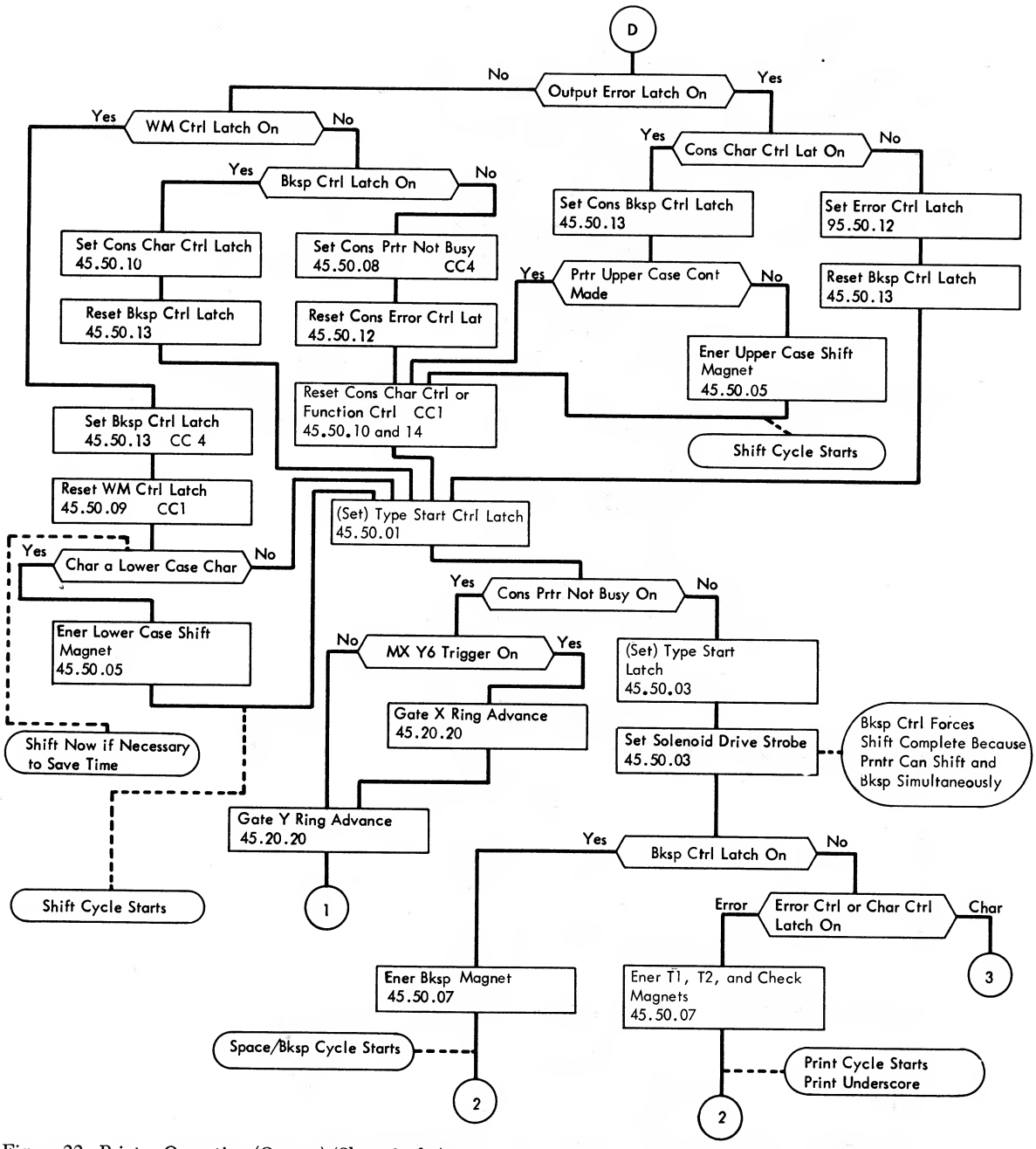


Figure 22. Printer Operation (Output) (Sheet 3 of 3)

The operated interposer also sets up the typehead motion. Lugs present on the interposer move the proper selector bails which operate the select latches to control the rotate and tilt motions. The C select latch will also be operated in the same manner if the parity set up by the other latches requires it.

The input cycle progresses as described in "Basic Print Cycle—Input." The input data lines are brought up by the select latch contacts. The console printer strobe trigger is turned on at 90 degrees, when the C1 N/O contact makes, and controls the input gating. There is no parity checking within the printer on input operations; the input data are checked on the A channel. After each input cycle, the matrix may or may not advance depending on the operation. For address set type input operations, the advance is controlled by the matrix address drive line which is brought up by the console printer strobe line. Console printer strobe and console strobe are shown in Figures 25 and 26.

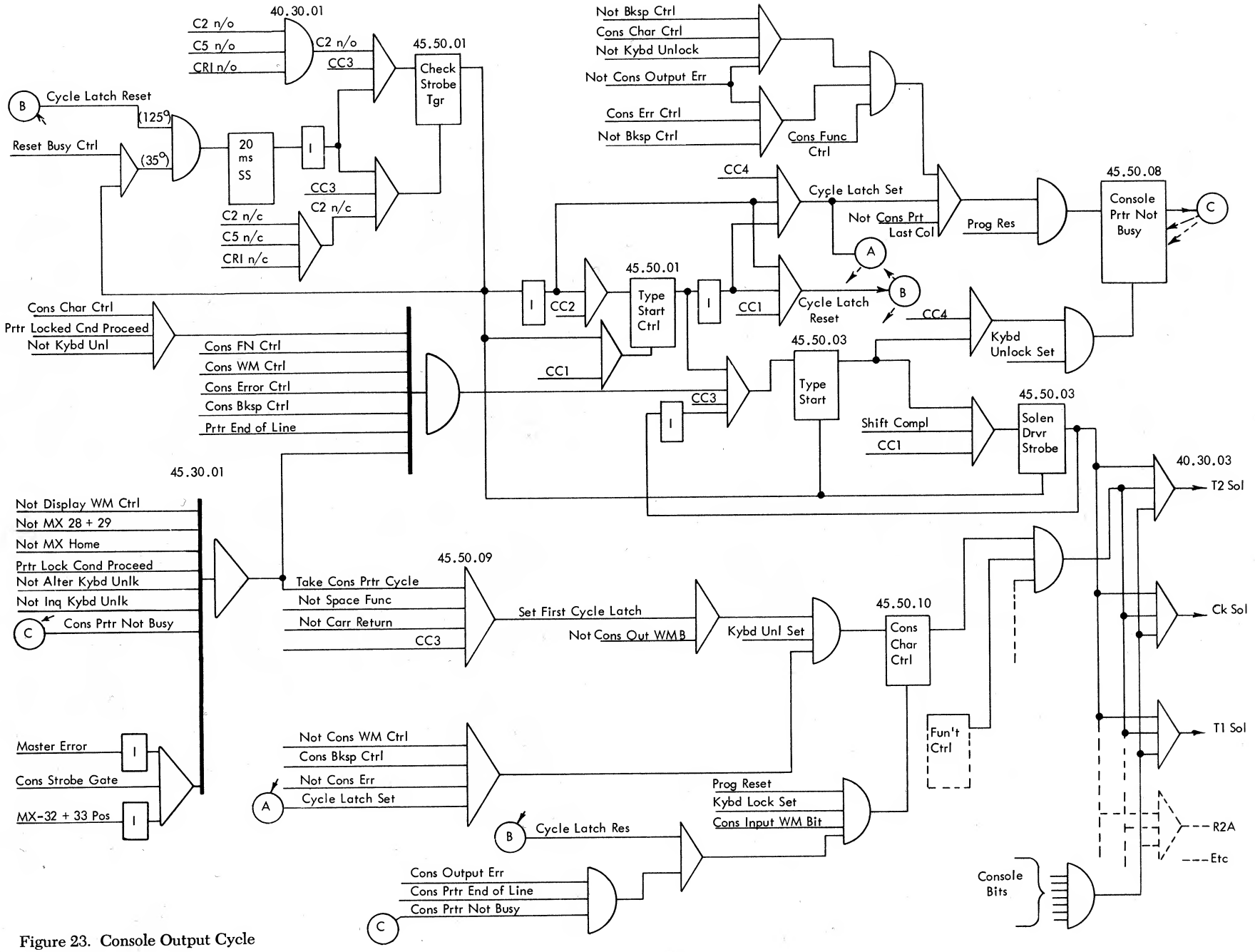


Figure 23. Console Output Cycle

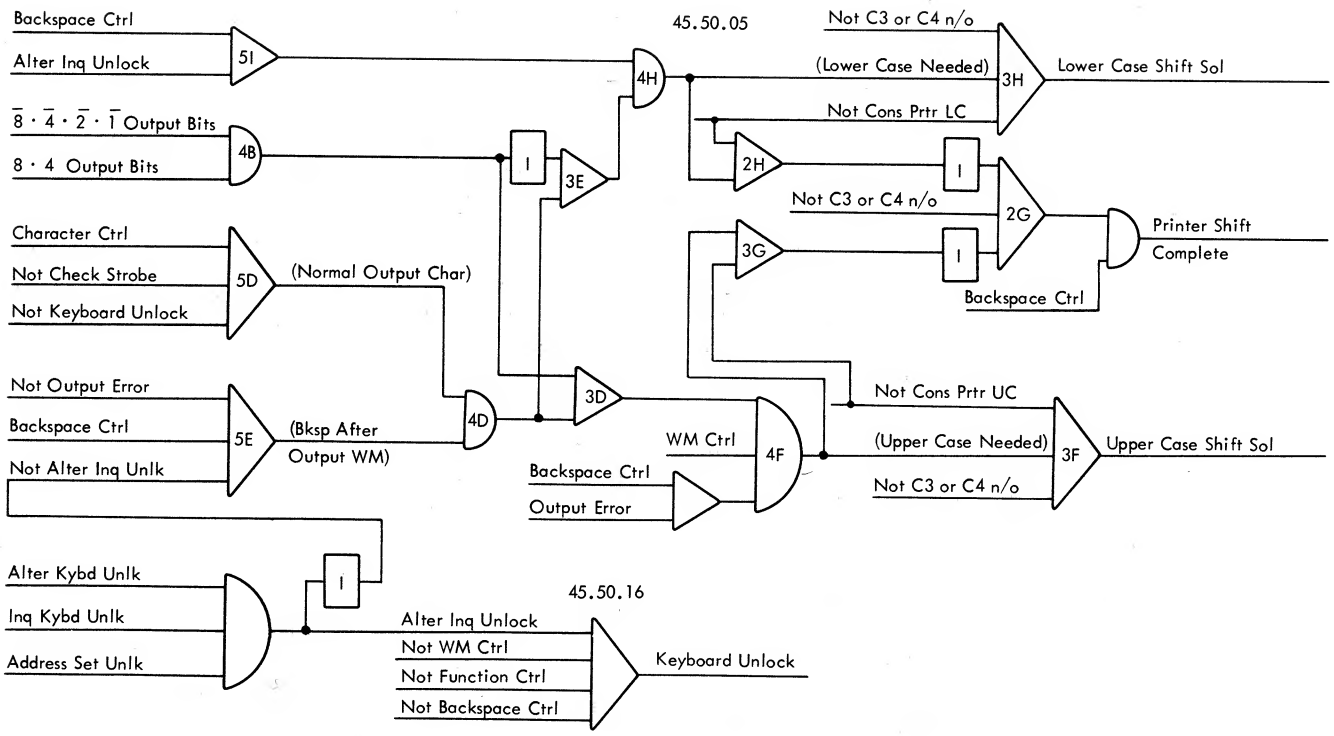


Figure 24. Shift Controls

Space Operation

Spacing on the 1-0 printer is accomplished by operating the escapement trigger. This is a normal occurrence in every print cycle and is performed by the filter shaft. If it is desired to space over a printing position, the escapement trigger is operated by the functional space cam mechanism. This mechanism is controlled by the space magnet or the spacebar. Two sets of contacts are operated during a space operation: the space transmitting contacts and the C5 feedback contact.

Output

During an output operation (Figure 27), a functional space cycle will be initiated by some particular matrix position or by the presence of a valid blank character (C bit only) in a move mode, write console printer operation. The take console printer cycle line is brought up as in a normal output print operation and turns on the type start latch. This latch turns on the solenoid driver strobe latch and also resets the console printer not busy latch to interlock the matrix. The matrix position or the write op move mode C bit brings up the console space function line and turns on the console function control latch. The solenoid driver strobe latch on, console space function line up, and console function control latch on combine on 45.50.07 to energize the space magnet. The rotate and tilt magnets cannot be energized since the console character control latch is not turned on.

Energizing the space magnet operates the space interposer, allowing the 180 degree cam to take a cycle. The space N/O contacts make at 50 degrees of the cycle to prevent the console printer strobe line from turning on the console output error latch (5H—45.50.11). At 55 degrees the feedback C5 N/O contact makes to activate the check strobe trigger which turns off the solenoid driver strobe latch to de-energize the space magnet. The C5 contact initiates the same circuit functions as the C2 contact does in a print cycle. The 180 degree cam rotation operates the escapement trigger and causes the typehead carrier to move one position. At 130 degrees, when the C5 N/C contact remakes, the console check strobe trigger is deactivated and cycle latch set and reset pulses are brought up to set up for the next cycle.

Input

An input functional space operation is started by pressing the spacebar. This action operates the space interposer, allowing the 180 degree cam to take a cycle and cause an escapement. The space N/O contacts made (50 degrees), and the check strobe trigger active (55

degrees) turn on the console printer strobe trigger. The space N/O contacts also provide a C bit input signal to the system (15.60.09) that is gated by the printer strobe line in the same way as a normal input character. The C5 feedback contact again controls the console check strobe trigger as C2 does for input print cycles.

Carrier Return

Console matrix positions 6A and 34 or console printer end of line initiate a carrier return and index operation (Figure 28) by bringing up the console carriage return line on 45.50.14. The take console printer cycle line combines with the console carriage return line to turn on the function control latch. The take console printer cycle line also turns on the type start latch. This latch turns on the solenoid driver strobe latch and also resets the console printer not busy latch to interlock the matrix. The solenoid driver strobe and the console carriage return lines combine on 45.50.07 to energize the CR magnet which operates the CR interposer. This action releases the 360 degree operational cam to start the CR index cycle.

As the 360 degree cam begins to rotate, it moves a cam follower that releases the line space mechanism and initiates the carrier return operation. At 145 degrees, the carrier return clutch latch transfers the N/O carrier return interlock (CRI) contact to activate the console check strobe trigger. This trigger turns off the type start latch and also turns off the solenoid driver strobe latch to de-energize the CR magnet. The carrier return latch keeper keeps the CRI contact transferred until the carrier return operation is completed. Since the CRI contact controls the check strobe trigger, no other operation (except shift) may be performed while the carrier is returning. When the carrier has reached the left margin, the CRI N/C contact is allowed to remake and deactivate the console check strobe trigger line. The cycle latch set pulse is brought up and combines with console function control to turn on the console printer not busy latch. The cycle latch reset pulse turns off the console function control latch.

Output Error Routine

When a parity error is detected during an output character print operation, the output error routine (Figure 29) causes the printer to backspace and print an underscore. If the output of the printer check network signals even parity and there is no word mark, or if the network signals odd parity and there is a word mark, the console output error latch is turned on with the console printer strobe at 90 degrees (Figure 25). At 125 degrees, when the C2 N/C contact remakes, the cycle latch set pulse is brought up at cc4. The cycle latch set pulse, console output error latch on, and the console character control latch on, combine to turn on the console backspace control latch (Figure 30). The cycle latch reset pulse, at cc1, turns off the console character control latch to prevent the rotate and tilt magnets from being energized.

The underscore, to be printed after the backspace cycle, is an upper case character. If a shift is needed, it will occur simultaneously with the backspace cycle. The console backspace control latch on, console output error latch on, and the upper case contact not made, energize the upper case shift magnet (5F—45.50.05). Since the backspace cycle can occur during a shift operation, the console backspace control latch forces up the console printer shift complete line so that the solenoid driver strobe latch may be turned on to energize the backspace magnet.

The backspace magnet operates the backspace interposer which trips the space/backspace clutch, allowing the 180 degree cam to rotate. During the backspace cycle, the C5 contact controls the console check strobe trigger; the backspace transmitting contact is not used. The C5 N/O contact makes at 55 degrees to activate the console check strobe trigger which resets the solenoid driver strobe to de-energize the backspace magnet. At 130 degrees, the C5 N/C contact remakes to deactivate the check strobe trigger and develop the cycle latch set and reset pulses. The set pulse turns on the console error control latch and the reset pulse turns off the console backspace control latch. The solenoid driver strobe latch is again turned on and combines with the console error control latch to energize the T1, T2, and check magnets and start the underscore cycle.

Since the underscore cycle is a print cycle, the C2 contact will control the console check strobe trigger. The console check strobe trigger active (35 degrees) and the console error control latch on will reset the console output error latch. At 125 degrees, the C2 N/C contact remakes to deactivate the console check strobe trigger and develop the cycle latch set and reset pulses. The set pulse turns on the console printer not busy latch to allow another character print operation to be started. The reset pulse turns off the console error control latch.

Word Mark Control

Three cycles are required to print a complete word-mark character: word-mark print cycle, backspace cycle, and a character print cycle. An output word-mark character initiates the three-cycle sequence.

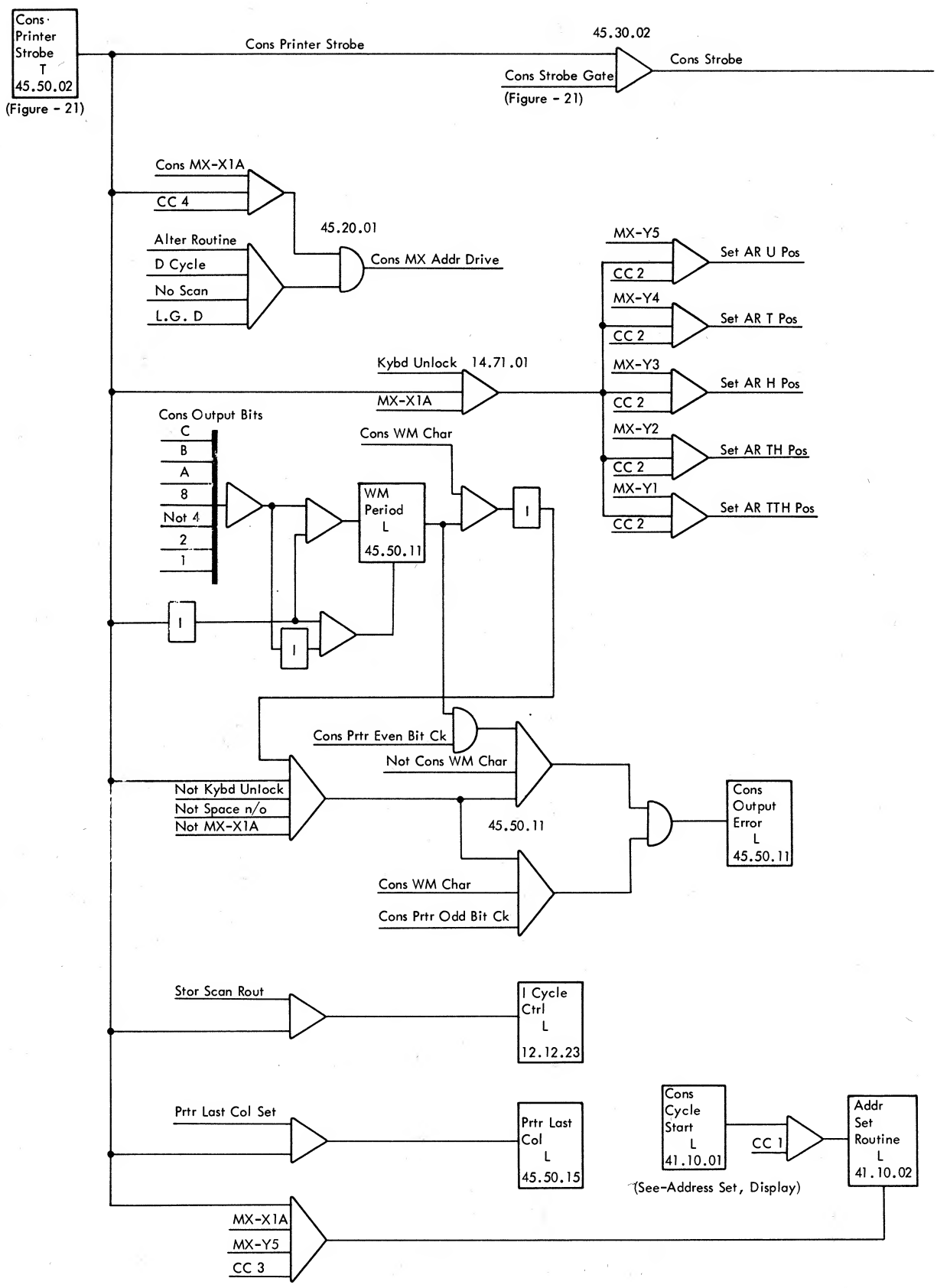


Figure 25. Console Printer Strobe

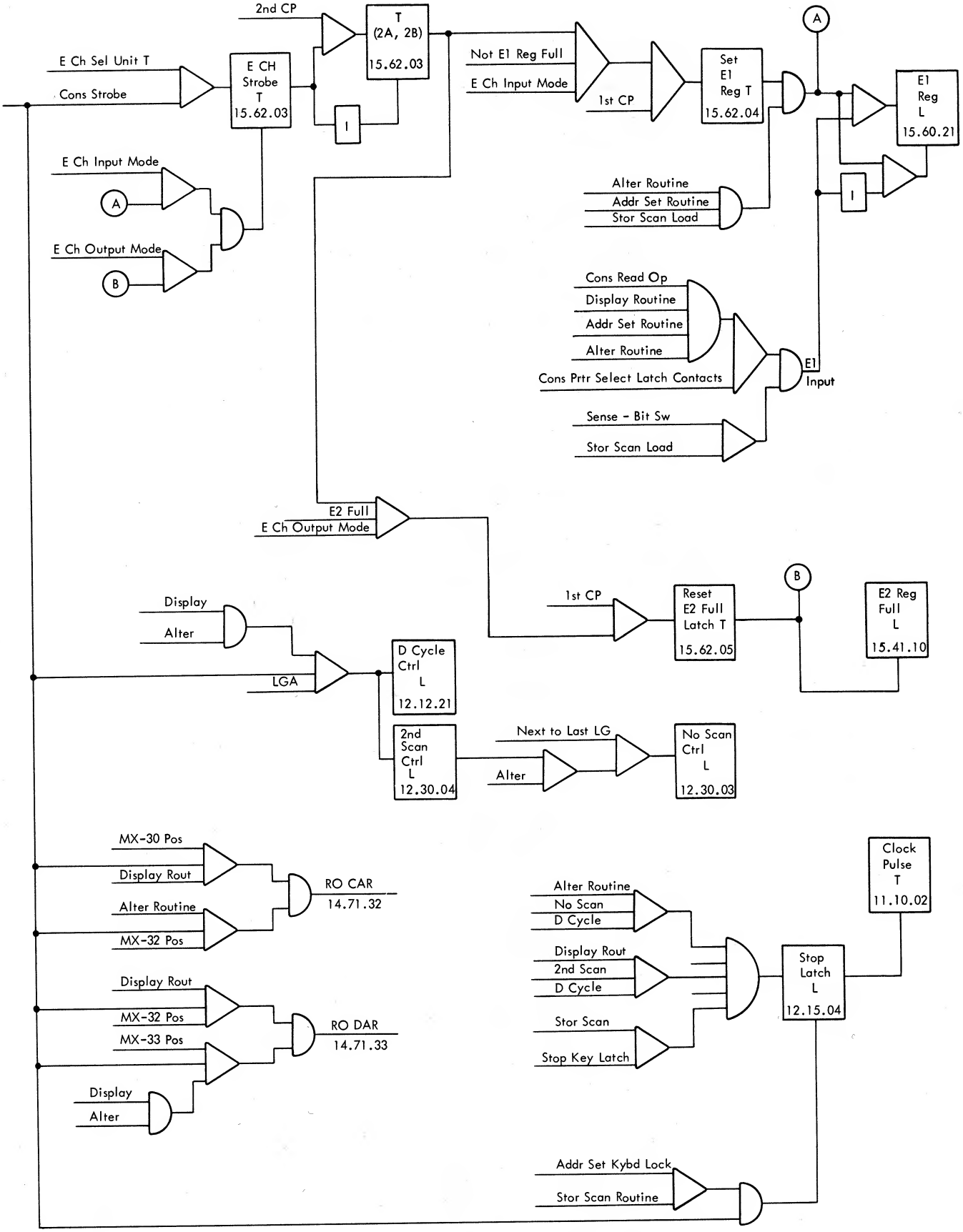


Figure 26. Console Strobe

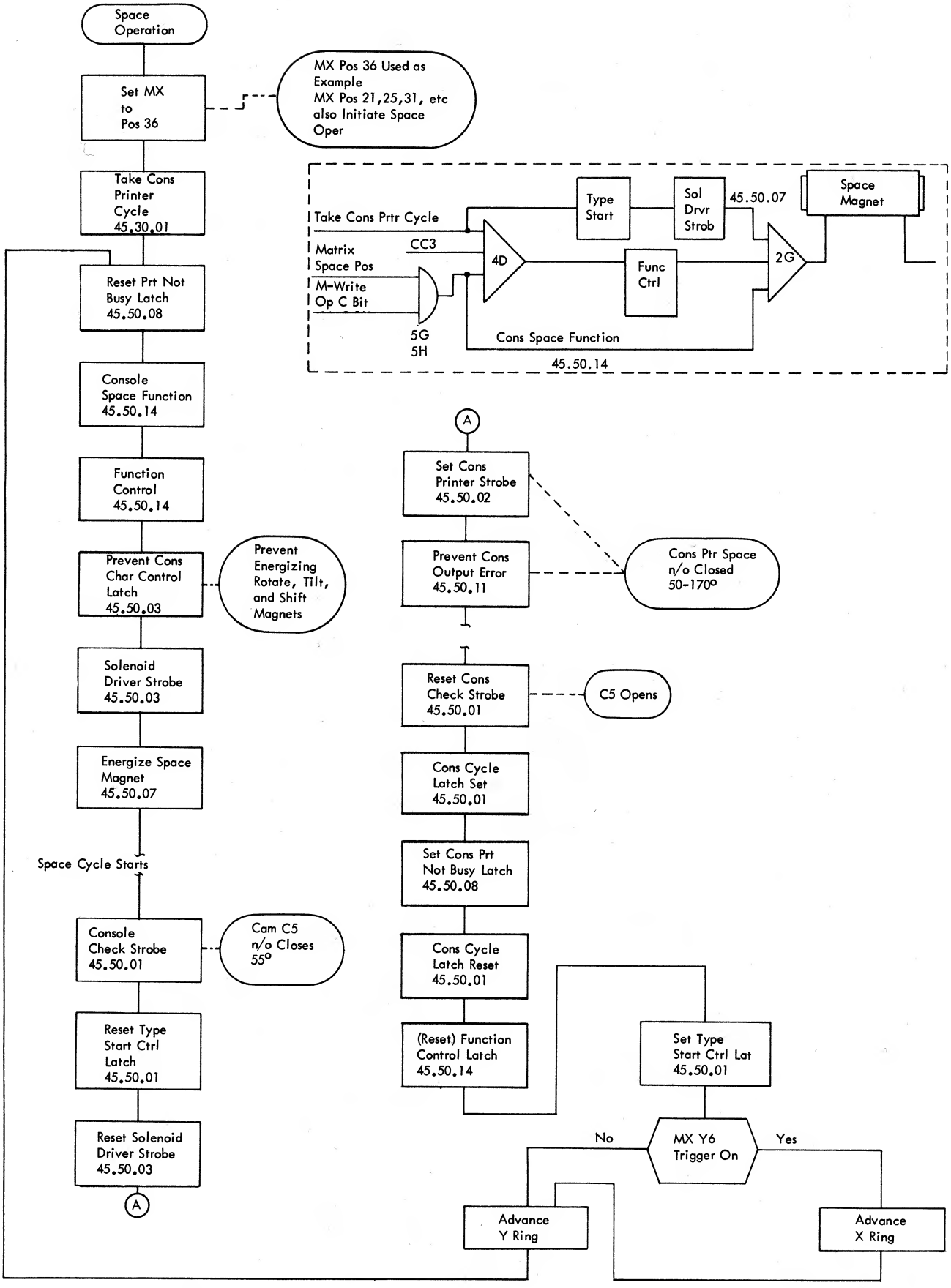


Figure 27. Console Output Space Operation

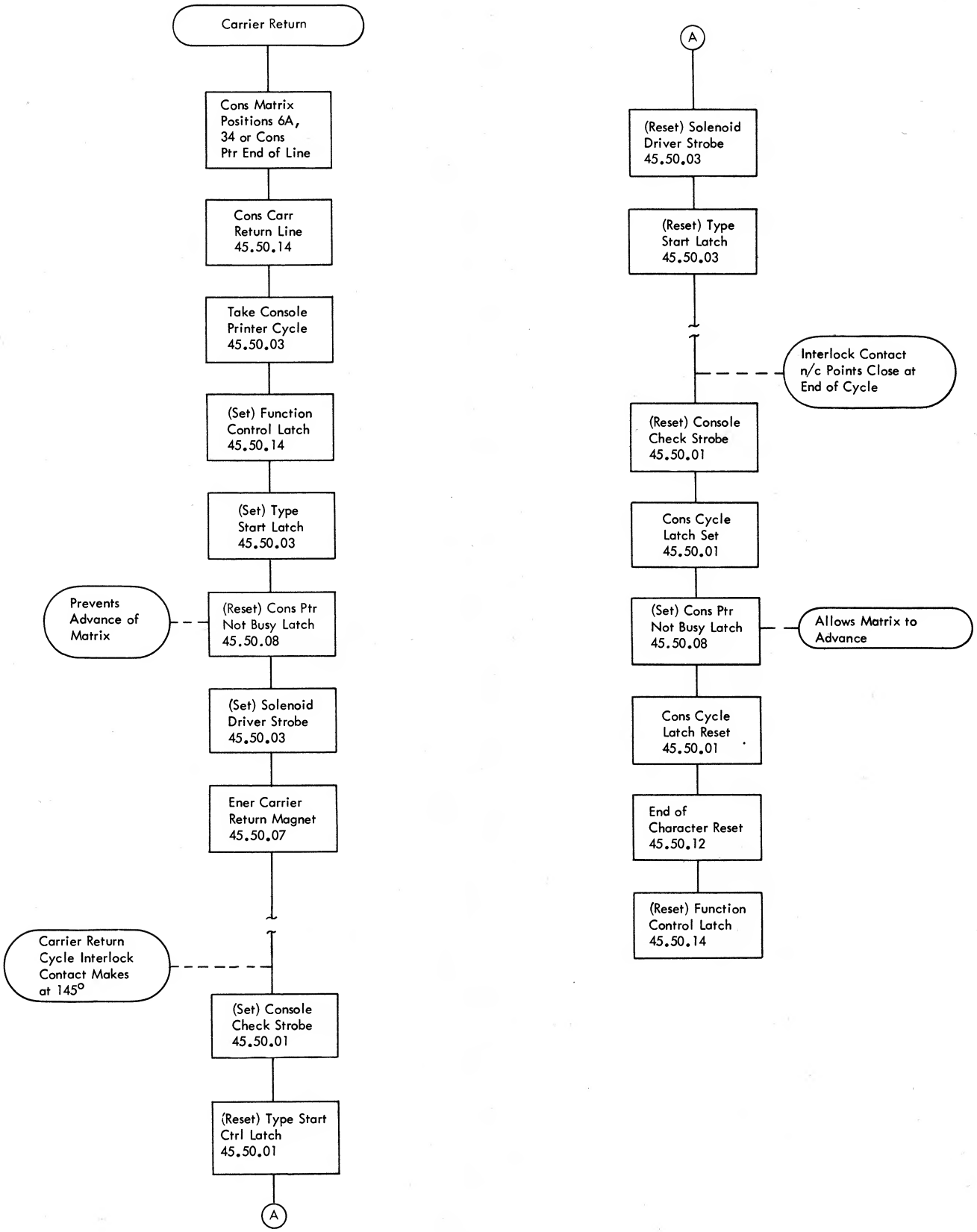


Figure 28. Carrier Return Operation

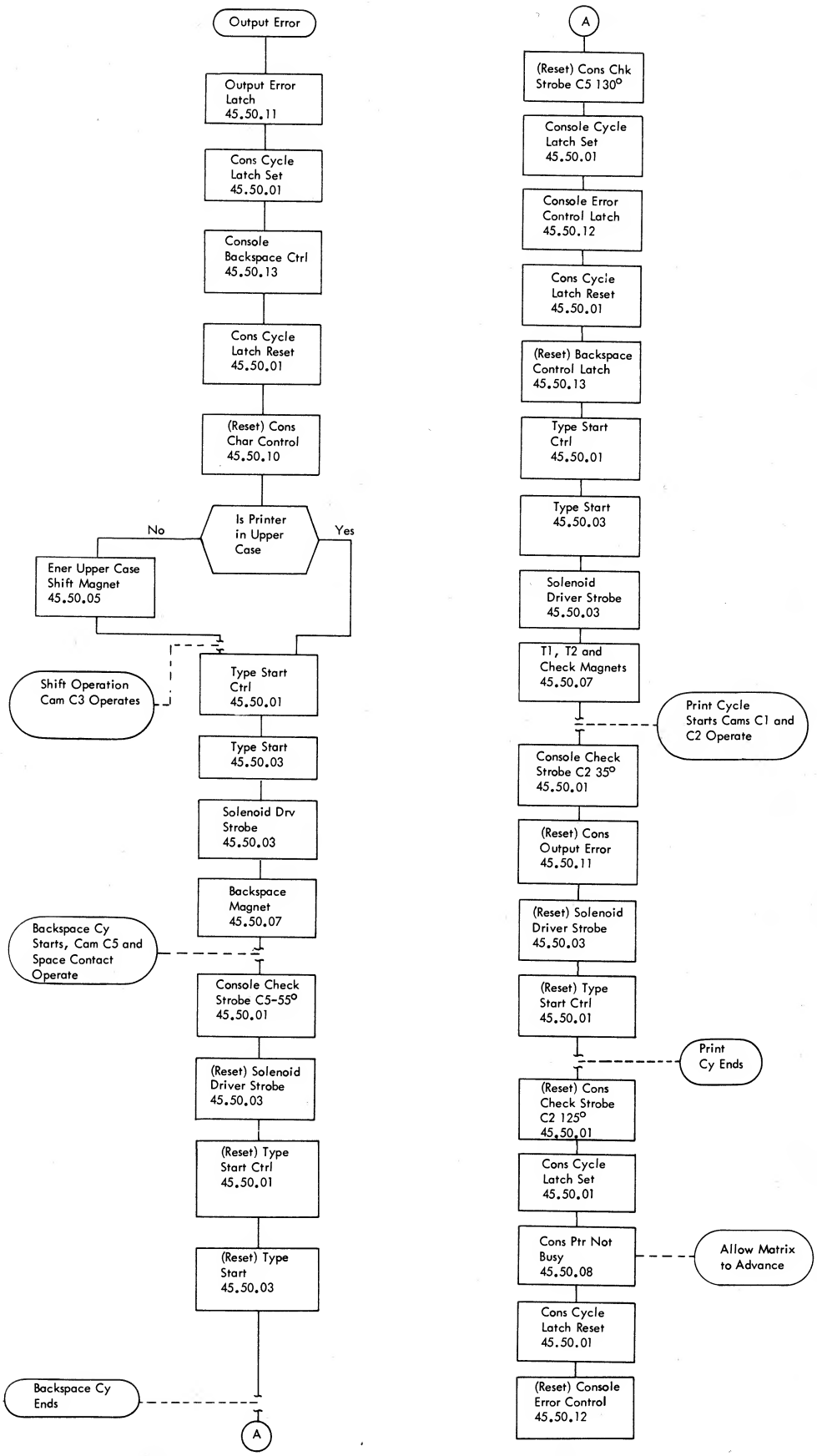


Figure 29. Output Error Routine

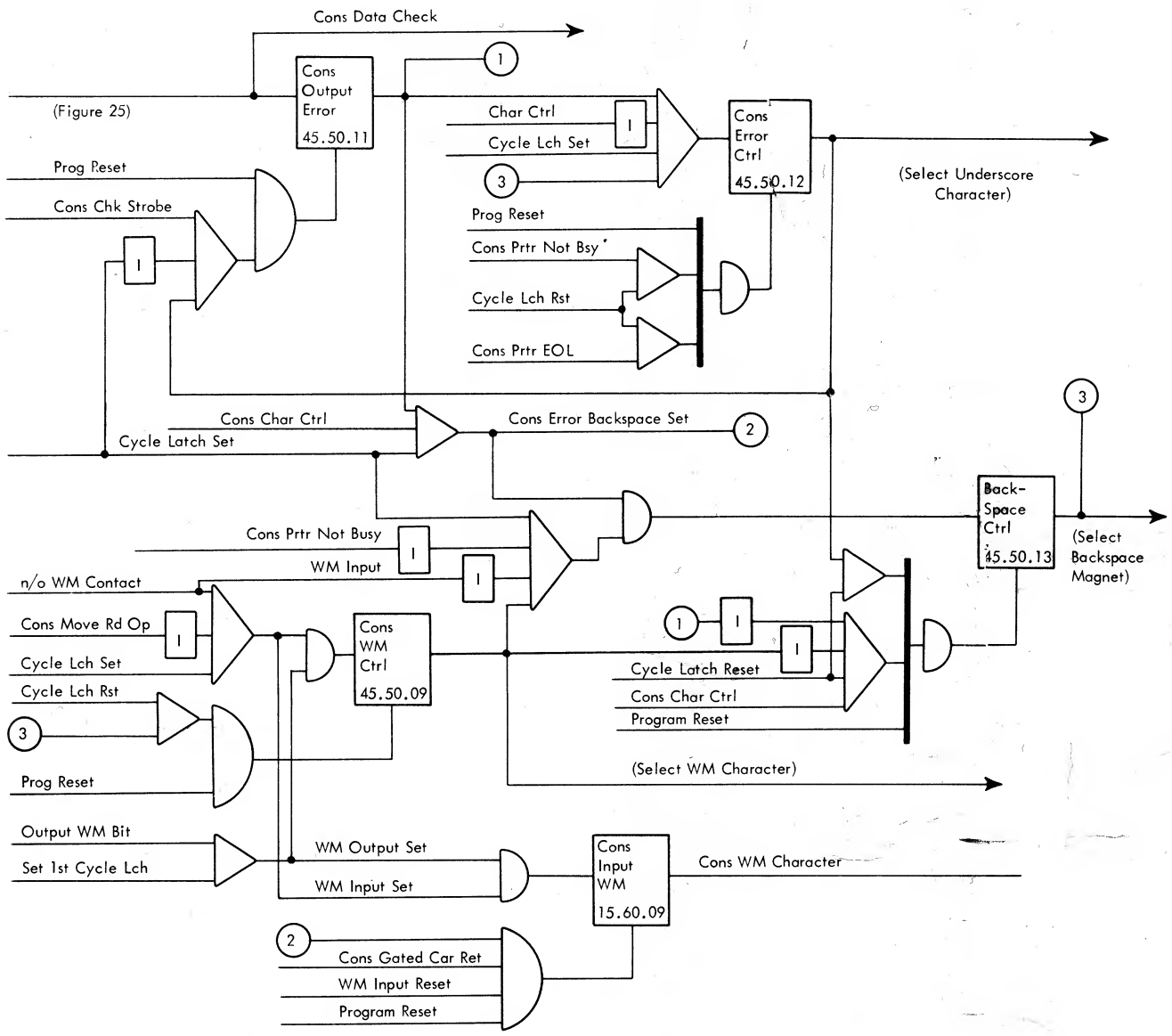


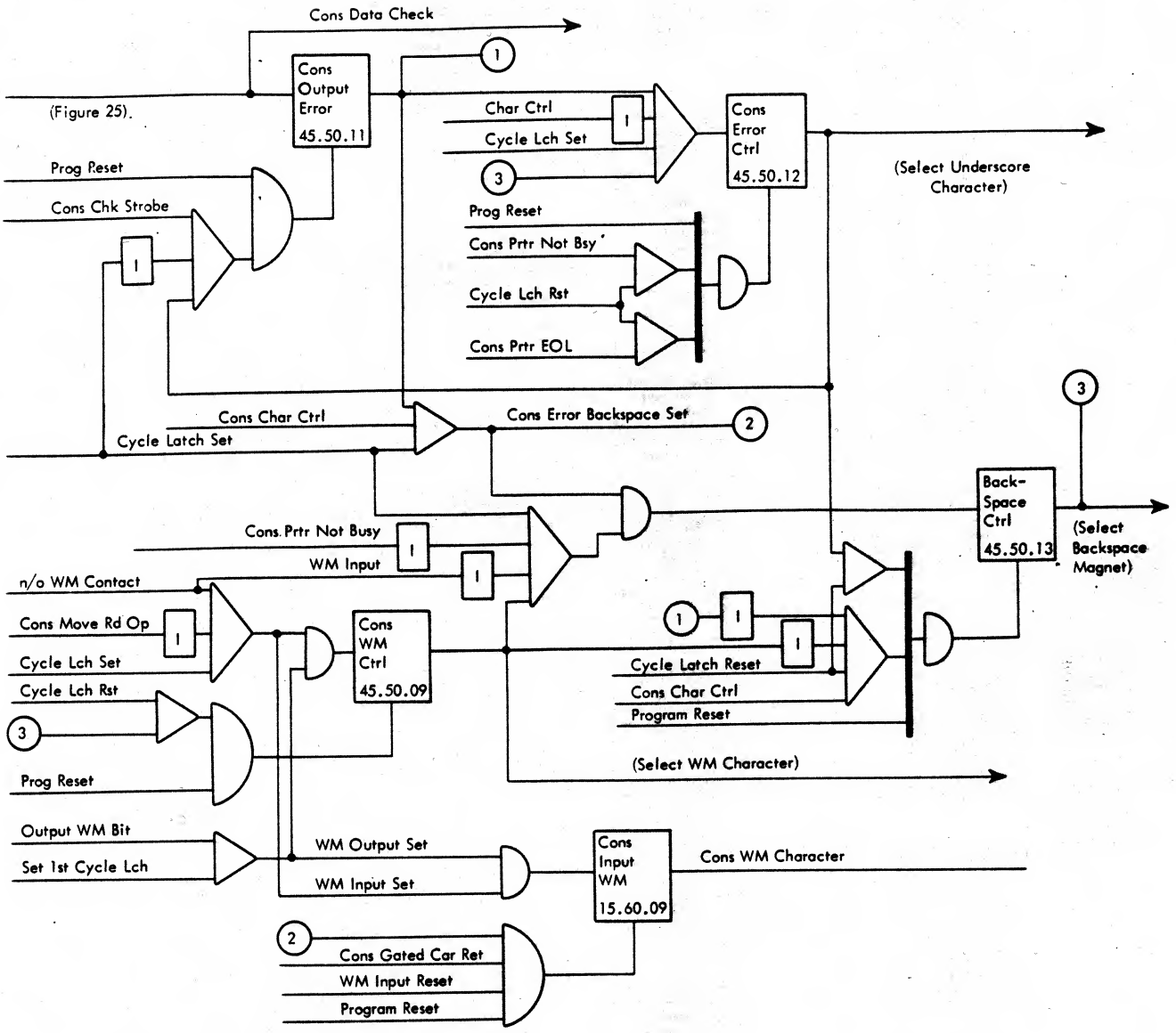
Figure 30. Word Mark and Error Controls

Pressing the WM key on input operations causes an output WM print cycle followed by a backspace cycle to occur. If a character key is then pressed, an input character print cycle will result with the character being printed under the word mark.

Output

When a character is gated to the console output lines, the presence of a word mark will turn on the console WM control latch (Figures 31, 32). The take console printer cycle line at CC3 brings up the set first cycle latch line which combines with the WM output bit to turn on the console WM control latch. The console output WM set line is activated to turn on the console WM input latch (15.60.09). At the same time the type start latch is turned on to reset the console printer not busy latch and interlock the matrix. The console character control latch is not turned on for this first cycle, to prevent the output bits from energizing the tilt and rotate magnets.

If the printer is not already in upper case, a shift cycle will be required. The console WM control latch on and the UC mode contact not made cause the upper case shift magnet to be energized (4F, 3F—45.50.05). At the end of the shift operation, the console printer shift complete line is brought up and allows the solenoid driver strobe latch to be turned on. The solenoid driver strobe latch on combines with the console WM control latch on to energize the check select magnet. Upper case and the check magnet energized will result in a word mark being printed.



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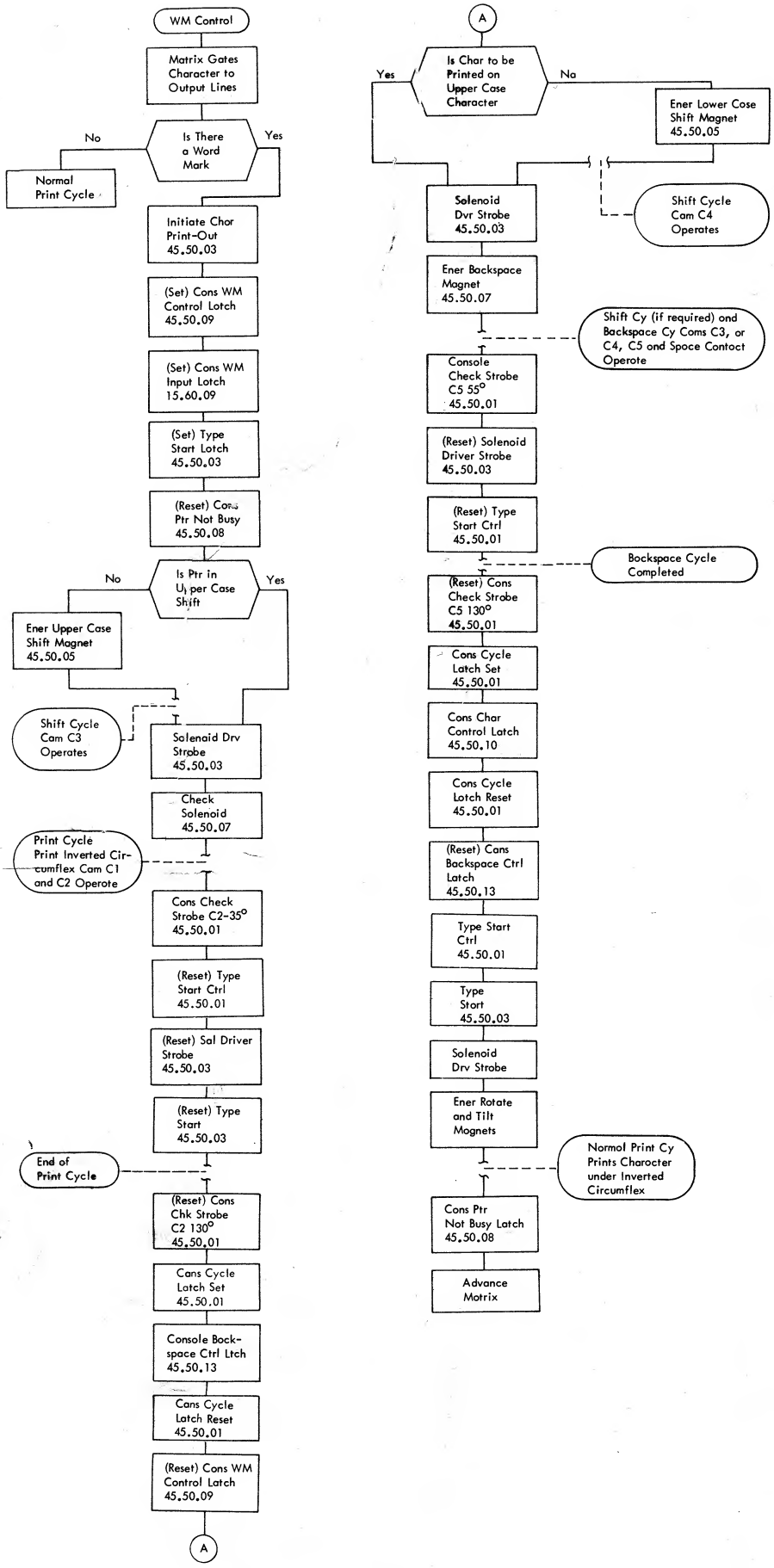


Figure 31. Word Mark Control (Output)

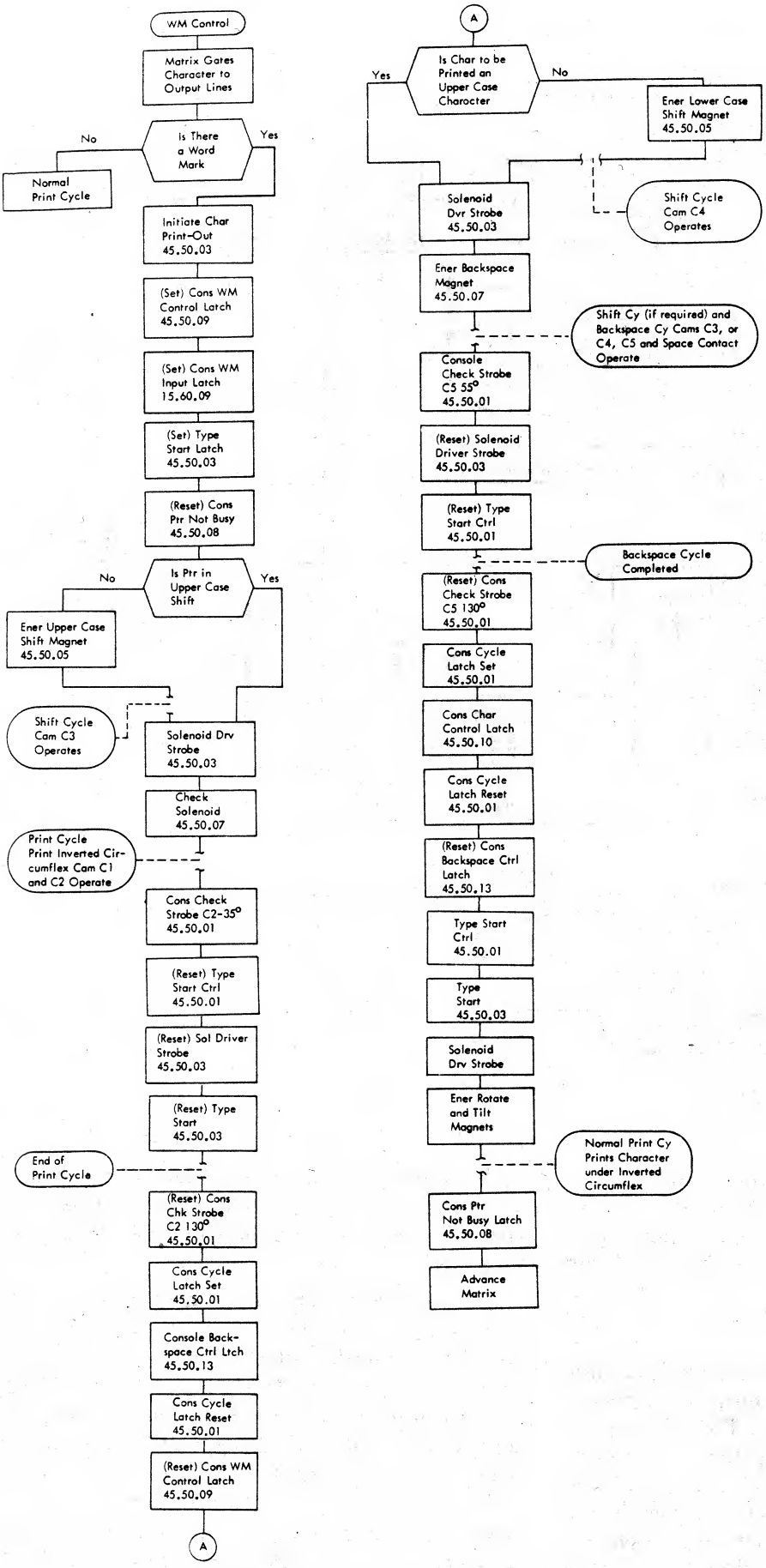


Figure 31. Word Mark Control (Output)

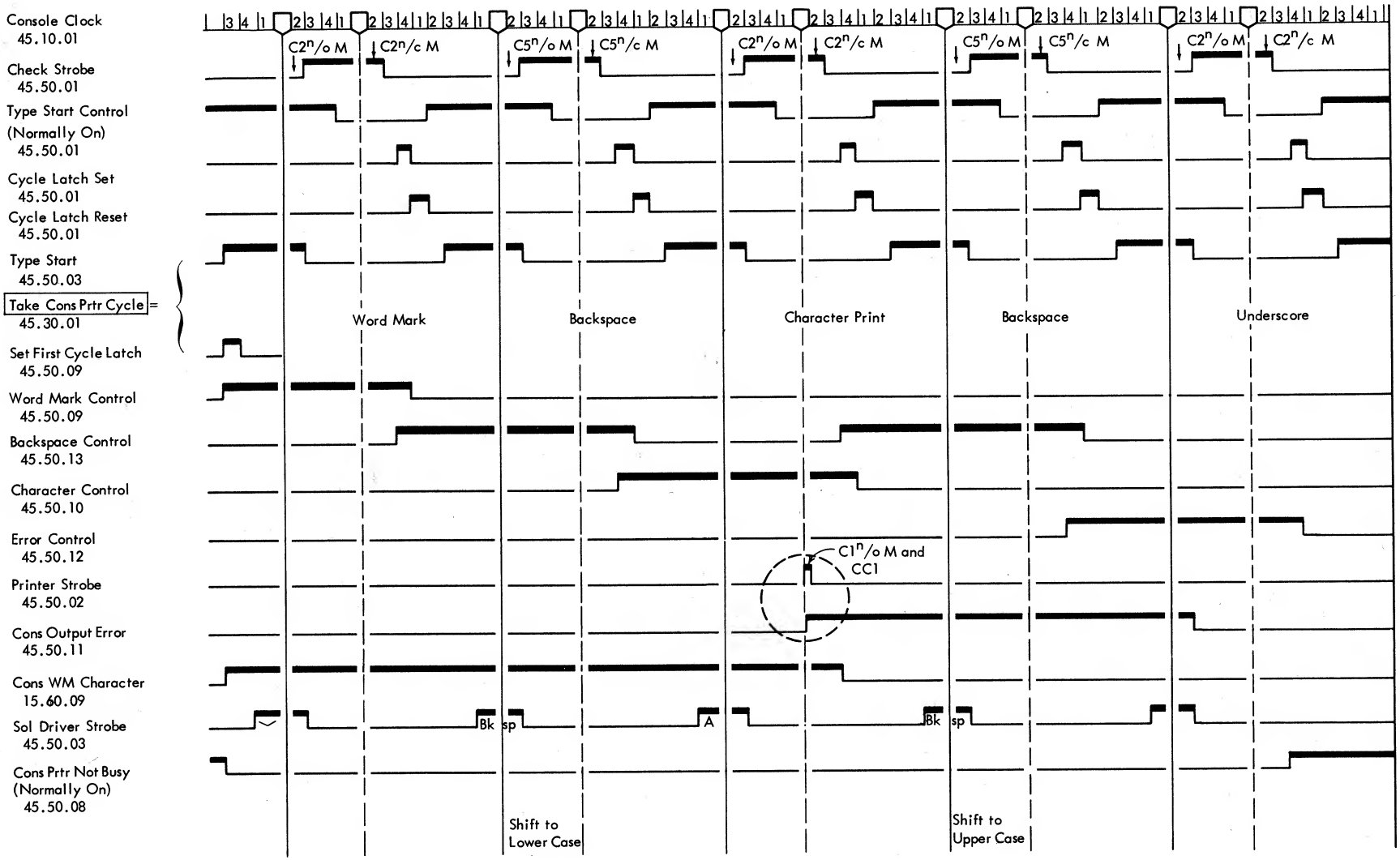


Figure 32. Output $\underline{\overset{V}{A}}$—Timing Chart

During this print cycle, the printer check network signals odd parity. Odd parity and the WM bit would indicate an error condition. However, since the console character control latch is not on, the console printer strobe trigger is not turned on, which prevents the turn-on of the console output error latch.

At 125 degrees, when the C2 N/C contact remakes, the console check strobe trigger is deactivated, which develops the cycle latch set and reset pulses. The set pulse turns on the console backspace control latch and the reset pulse turns off the console WM control latch. If a shift cycle is required for the character to be printed, it will occur during the backspace cycle. The console backspace control latch on, allows the proper shift magnet to be energized, if needed (5E—45.50.05). The console backspace control latch also forces the console printer shift complete line up to allow the solenoid driver strobe latch to be turned on. The solenoid driver strobe and the console backspace control latch on combine to energize the backspace magnet which starts the backspace cycle.

During the backspace cycle, the C5 feedback contact controls the console check strobe trigger. The cycle latch set and reset pulses are developed at 130 degrees when the C5 N/C contact remakes. The set pulse turns on the console character control latch and the reset pulse turns off the console backspace control latch. The solenoid driver strobe latch is again turned on and combines with the console character control latch on and the console assembly bits to energize the proper select magnets and initiate a normal print cycle.

In this print cycle the character prints under the previously printed word mark. The C2 feedback contact again controls the console check strobe trigger. At 90 degrees, the C1 N/O contact makes and brings up console printer strobe which samples the output of the select latch contact network for parity. The error circuits are conditioned by the console WM character line which is developed by the console WM input latch. The C2 N/C contact makes at 125 degrees to signal that the operation is electrically finished. The console character control latch on and the cycle latch set pulse turns on the console printer not busy latch. The cycle latch reset pulse turns off the console character control latch.

Input

Word-mark input utilizes a portion of the tab mechanism to operate the word-mark transmitting contacts and the C5 feedback contact. Pressing the word-mark (tab) key and key lever operates a bail that causes a similar key lever on the right side of the printer to operate the word-mark (tab) interposer. The unlatched interposer allows the 180 degree cam to take one cycle and operate the word-mark contacts. This is the only direct action resulting from the word-mark key. When the 1411 recognizes the word-mark input signal, it causes an output word-mark print cycle and a backspace cycle to occur.

At 50 degrees of the functional 180 degree word mark cycle, the word-mark transmitting contact makes to provide the word-mark input signal line. This line stays up until the contact breaks at 170 degrees. The C5 N/O feedback contact makes at 55 degrees to turn on the console check strobe trigger. At 130 degrees, the C5 N/C contact remakes and turns off the check strobe trigger which brings up the cycle latch set pulse at the following cc4. On 45.50.09 the word-mark input signal line (still up) combines with the cycle latch set pulse and the console move read op line down, to turn on the console word mark control latch. The console WM control latch initiates an upper case shift, if needed (3F—45.50.05). The console WM control latch also turns on the type start latch which turns on the solenoid driver strobe latch when the shift complete line comes up. The solenoid driver strobe latch and the console WM control latch combine to energize the check select magnet which results in a word-mark print cycle. During the word-mark print cycle, when the C2 N/C contact remakes, the console check strobe trigger is deactivated which brings up the cycle latch set pulse to turn on the console backspace control latch.

A normal backspace operation is started and the C5 contact controls the console check strobe trigger. At 130 degrees when the C5 N/C contact remakes, the cycle latch set pulse is again brought up and turns on the console character control latch. An output character print cycle will not occur because the solenoid driver strobe latch is not turned on at this time. Since this is an input operation, the keyboard unlock line at 5C (45.50.03), prevents the turn-on of the type start latch which prevents the solenoid driver strobe latch from being turned on.

Because no character print cycle occurs, the cycle latch set and reset pulses are not brought up and the console character control latch will remain on. The operator may now press a character key and a normal character print input operation will result with the character printing under the previously printed word mark.

When the word-mark transmitting contact was made at 50 degrees in the WM function cycle, a console WM input set signal was sent to the 1411 and turned on the console WM input latch (15.60.09). This latch brings up the console WM character line (Figure 30), which develops the E1 input WM bit (15.60.08). When the char-

acter under the word mark is printed, the presence of a console C input signal is checked by the console WM input latch so that odd input parity is maintained by controlling the input C bit (2D, 2E—15.60.09).

Stop Print-Out

The stop print-out that occurs each time the system stops, gives a log of system operations, allows the operator to determine what caused the system to stop, and permits the programmer to follow a program, step by step, through the system. The printing layout and the matrix positions used for a stop print-out are shown in Figure 16. There are three different types of stop print-outs: normal stop, cycle stop, and error stop.

A normal stop print-out is identified by an S that prints in the first printing position and occurs with any of the following conditions:

1. A program stop op code.
2. A pressed stop key.
3. Rotating the mode switch to another position.
4. An I-O error when the system is in the 1401 mode and the I-O check stop switch is on.
5. An address stop from the 1411 CE panel switches.

A cycle stop print-out is identified by a C in the first printing position. Any of the following conditions initiates a cycle stop:

1. Completion of instruction read-out and mode switch set to I/E cycle.
2. End of an execute cycle and mode switch set to I/E cycle.
3. End of each memory cycle and cycle control switch set to storage cycle.
4. End of each logic gate pulse and cycle control switch set to logic step.

An error stop print-out occurs whenever the master error line is brought up. It is identified by an E in the first printing position.

OPERATION

When a stop print-out is initiated, a carrier return is the first printer operation to occur. When the carrier return is completed, matrix position 35 is gated on and the special character (S, C, or E) is printed in the first printing position. The matrix is then advanced to MX36 and a space operation is performed. MX1 is gated on next, to start the print-out of the IAR. The matrix advances sequentially from MX1 through MX29 while the printer prints out the register and channel data specified for these positions. Matrix position 34 is then gated on to initiate a carrier return which completes the operation.

To obtain a stop print-out, the stop condition latch must be on when the system stops. The stop condition latch is turned on with a second clock pulse every time the CPU clock starts except when the print-out control switch is set to "inhibit" or when the mode switch is set to "display" or "alter." The "inhibit" position of the print-out control switch is used when no stop print-outs are desired; the system will stop without printing. The "display" and "alter" positions of the mode switch prevent the stop condition latch from being turned on because it is not desired to have a stop print-out occur after each display or alter character. The description that follows is for a normal stop print-out initiated by the console stop key (Figure 33).

A stop print-out cannot occur until the CPU clock stops. Pressing the console stop key causes the stop key latch to be turned on. When the last execute cycle line comes up, the stop key latch on turns on the stop latch at second clock pulse of logic gate Z (Figure 34). If neither the E nor the F channel is in use, the stop latch stops the clock at first clock pulse.

The clock stopped line up, console matrix at home, and the stop condition latch on, combine to bring up the console stop print-out condition line. This line and the console stop print latch off bring up the console stop reset line. At 4F, 3F, and 3G on 44.10.03 is a latch that will be referred to as the console stop CR control latch. This latch, off at this time, combines with the console stop reset line up and the console printer not busy latch on, to allow the carrier return magnet to be energized.

During the carrier return cycle, the carrier return interlock (CRI) N/O contact makes at 145 degrees to activate the console check strobe trigger line. The console stop reset line and the check strobe trigger line combine to turn on the console stop CR control latch. This latch, when on, drops the drive to the CR magnet and interlocks the circuit so that only one carrier return may occur. When the carrier is fully returned, the CRI N/C contact remakes to deactivate the console check strobe trigger which combines with the console stop CR control latch on, to bring up the console stop CR complete line. At CC4, the console stop CR complete line up, console stop print-out condition line up, and matrix at home, turn on the console stop print latch. Figure 35 is a timing chart of the stop print-out operation. The chart begins at 145 degrees of the CR cycle.

The console stop print latch on and the stop condition latch on permit matrix position 35 (X-6, Y-5) to be gated on, to allow printing of the identification character. On 44.10.02, not master error and the console stop print latch on bring up a line that combines with

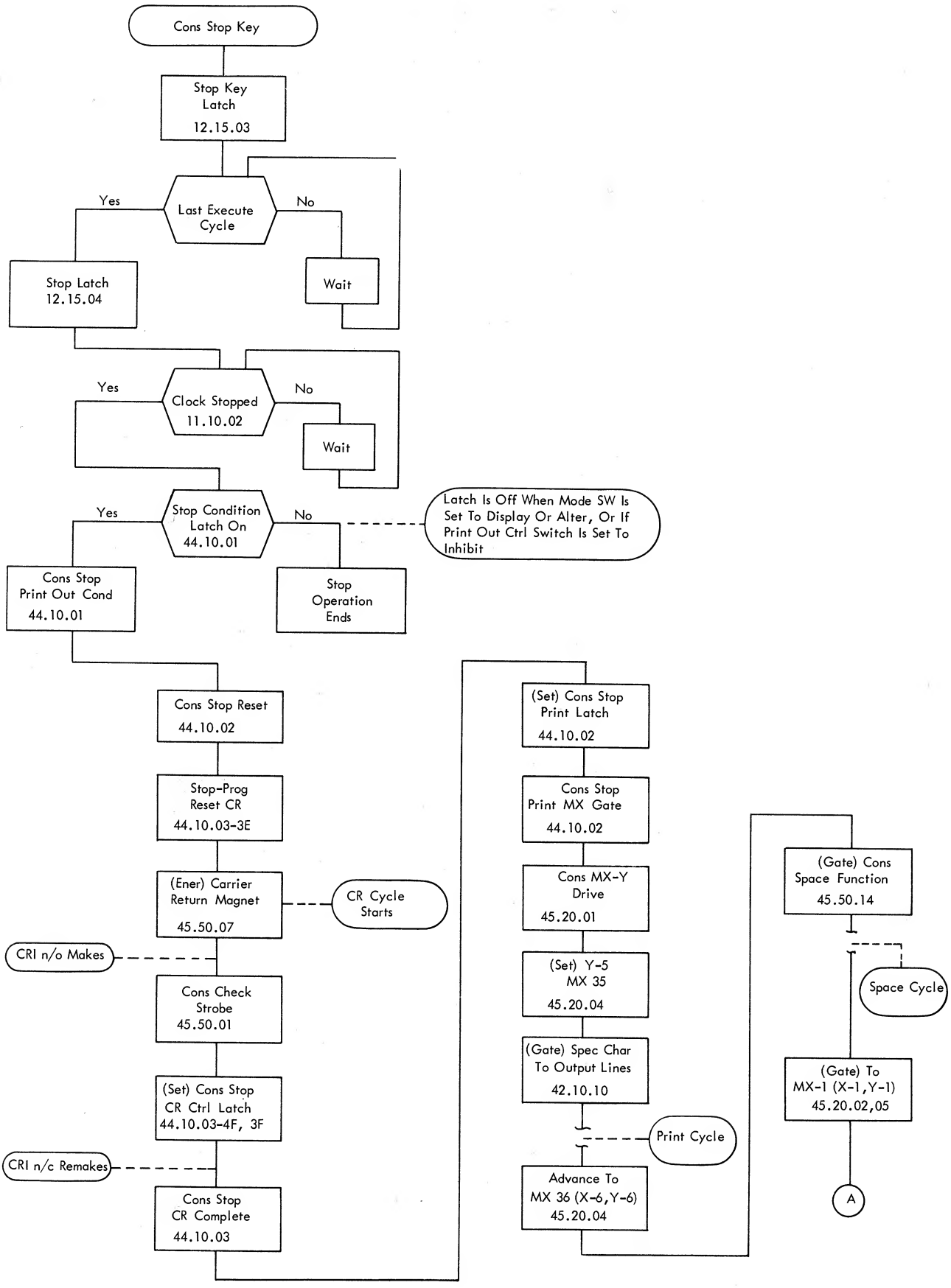


Figure 33. Stop Print-Out Operation (Sheet 1 of 3)

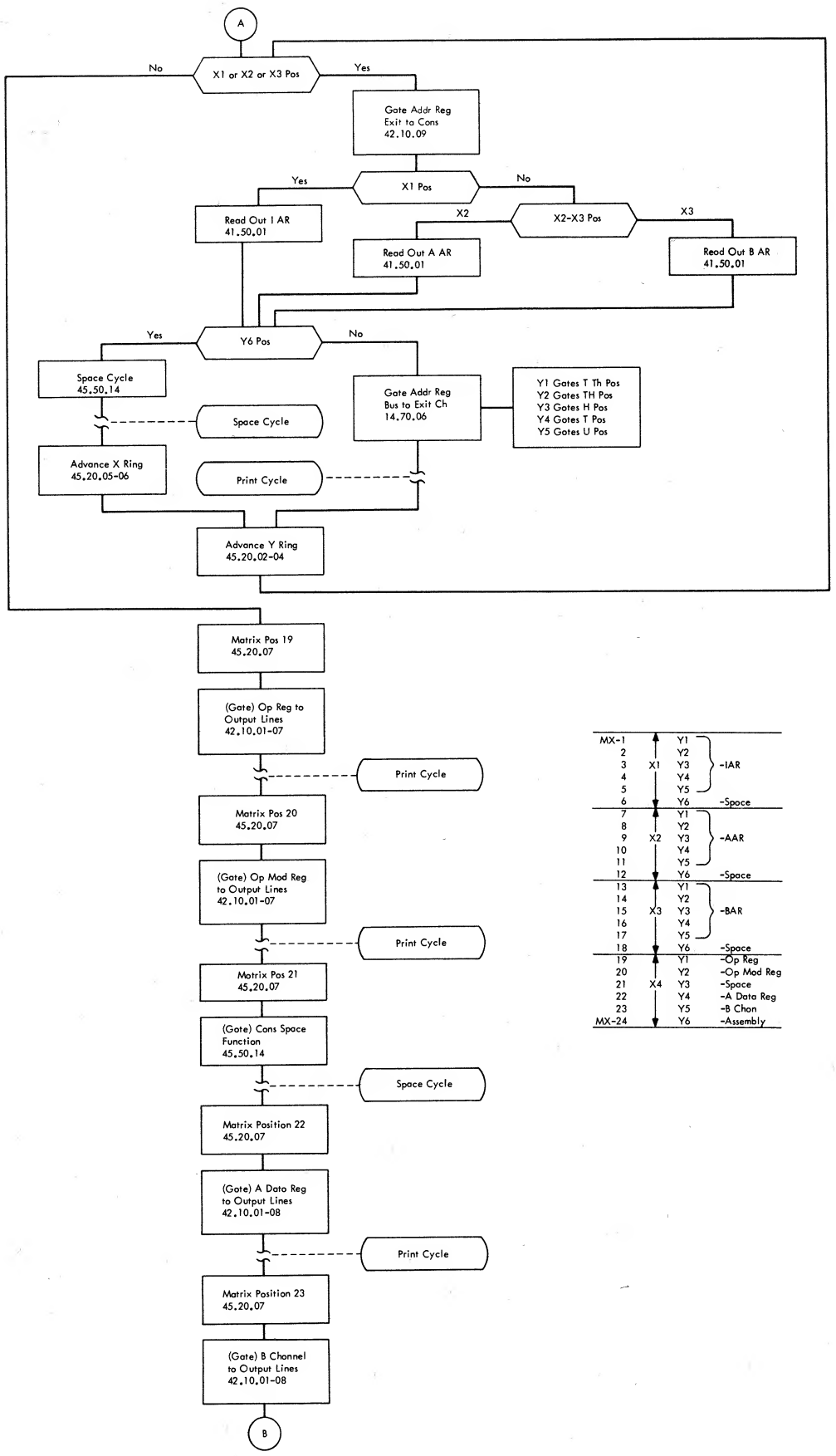


Figure 33. Stop Print-Out Operation (Sheet 2 of 3)

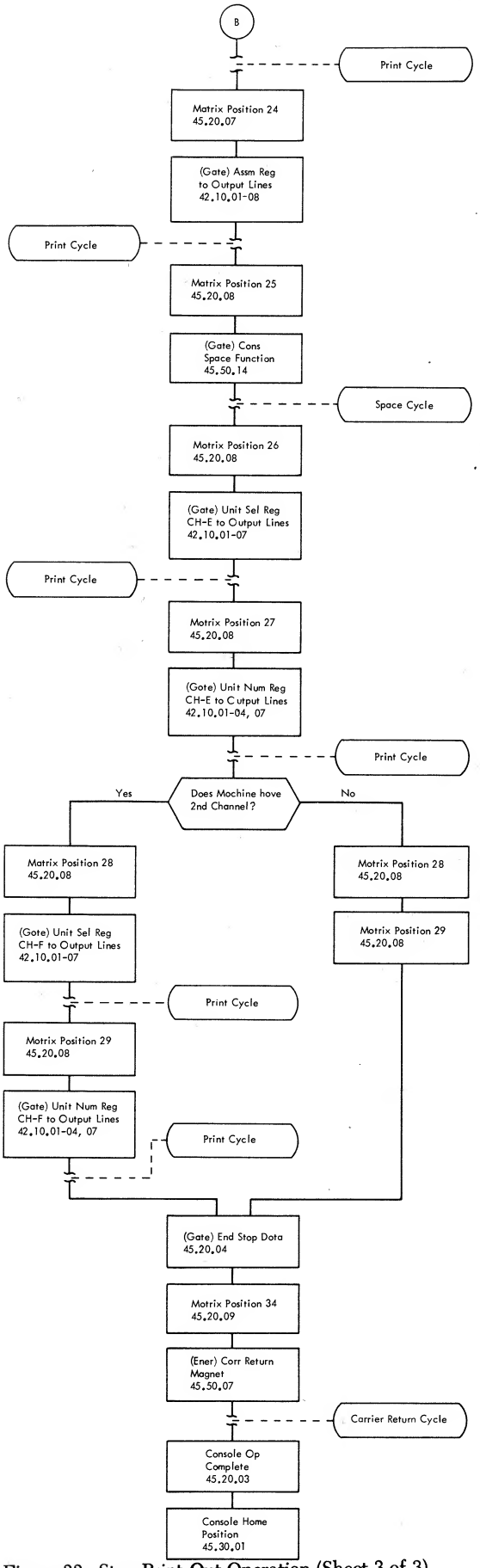


Figure 33. Stop Print-Out Operation (Sheet 3 of 3)

MX35 to send the special character S to the console output bit lines. At the next cc3 pulse, the console stop print latch on and MX35 turn off the stop condition latch.

MX35 and the S on the console output lines cause a normal output print cycle to occur. When the C2 N/C contact remakes, the console check strobe trigger line is deactivated. The cycle latch set pulse that is developed at cc4 turns the console printer not busy latch on again. The console printer not busy latch on and the console check strobe trigger line down bring up the console MX-Y drive line at the next cc2 pulse (45.20.10). The MX-Y drive line sets the Y-6 trigger, which advances the matrix to MX36 (X-6, Y-6) to initiate an output space operation (see "output" under "Space Operation").

At 130 degrees of the space operation, the C5 N/C contact remakes to deactivate the console check strobe trigger. The cycle latch set pulse again turns on the console printer not busy latch at cc4. The console printer not busy latch on, console check strobe trigger line down, and the matrix X-6 trigger on, combine to bring up the MX-X drive line at cc1. The console stop print latch on and the matrix X-6 trigger on gate the matrix X-1 trigger which is set with the MX-X drive line (45.20.05).

The matrix X-6 trigger on also controls the gating of the Y-1 trigger. The console check strobe line down and the console printer not busy latch on combine at cc2 to bring up the MX-Y drive line which sets the Y-1 trigger at cc2. The matrix X-1 and Y-1 triggers on (MX1) permit the printing out of the IAR to begin.

Whenever the matrix X-1, X-2, or X-3 triggers are on, the console address register exit gate line (42.10.09) gates the address register exit channel to the console. The console matrix X-1 trigger position combines with the console stop print latch on to gate the IAR to the address bus (41.50.01). Console matrix Y-1 position brings up the address scanner 6 position line on 14.70.06 to gate the ten-thousands position digit from the address bus to the printer. Matrix Y-2 position gates the thousands position digit; Y-3, the hundreds position digit; Y-4, the tens position digit; and Y-5, the units position digit. A print cycle is initiated for each digit by the take console printer cycle line, which is brought up when the console printer not busy latch is turned on. The console printer not busy latch on also controls the advance of the matrix.

When the matrix Y-6 trigger is turned on (MX6), an output space operation is initiated. The matrix is then advanced to MX7 (X-2, Y-1) to start printing out the AAR. The AAR and BAR print out in the same manner as described for the IAR. The X-2 trigger on controls

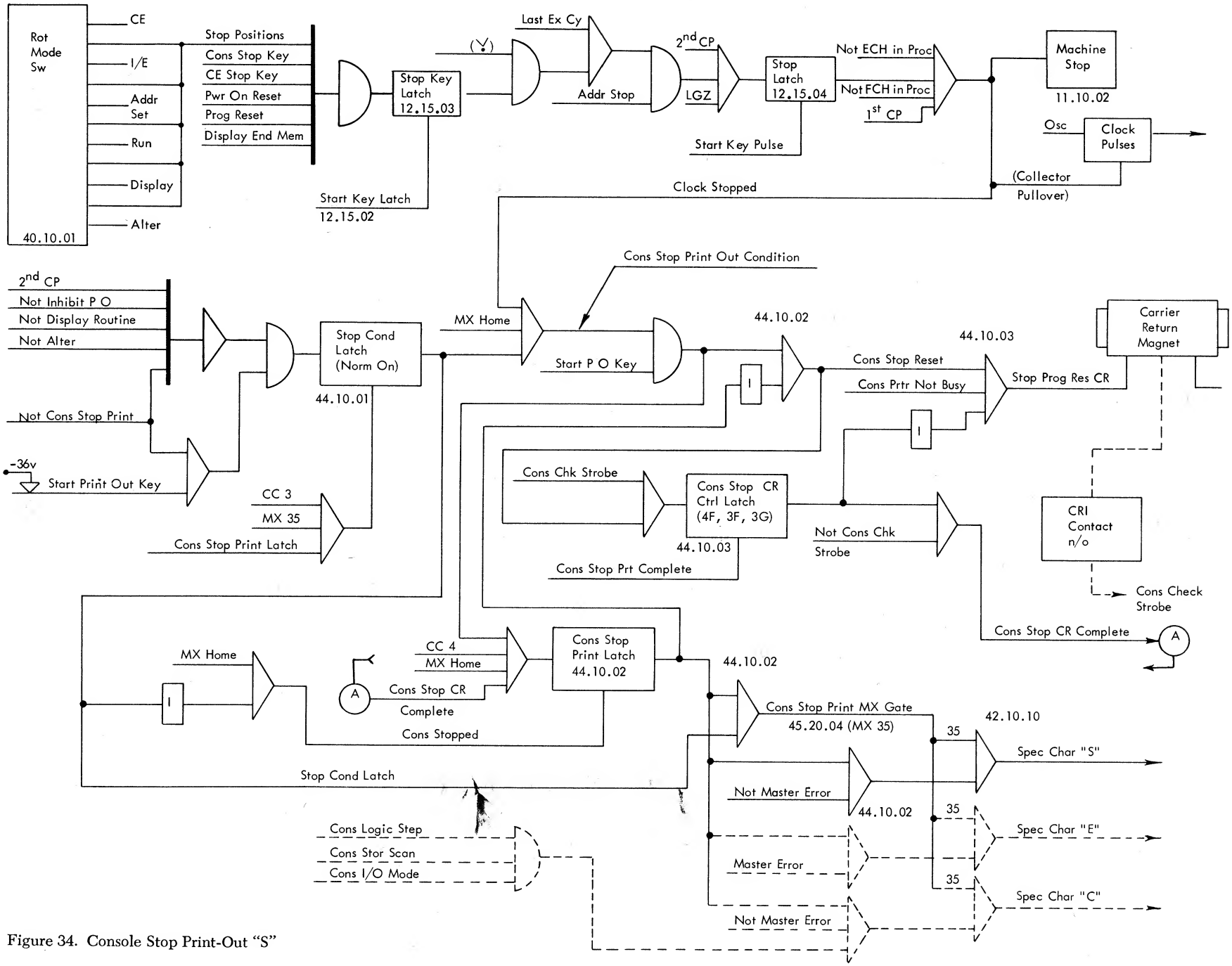


Figure 34. Console Stop Print-Out "S"

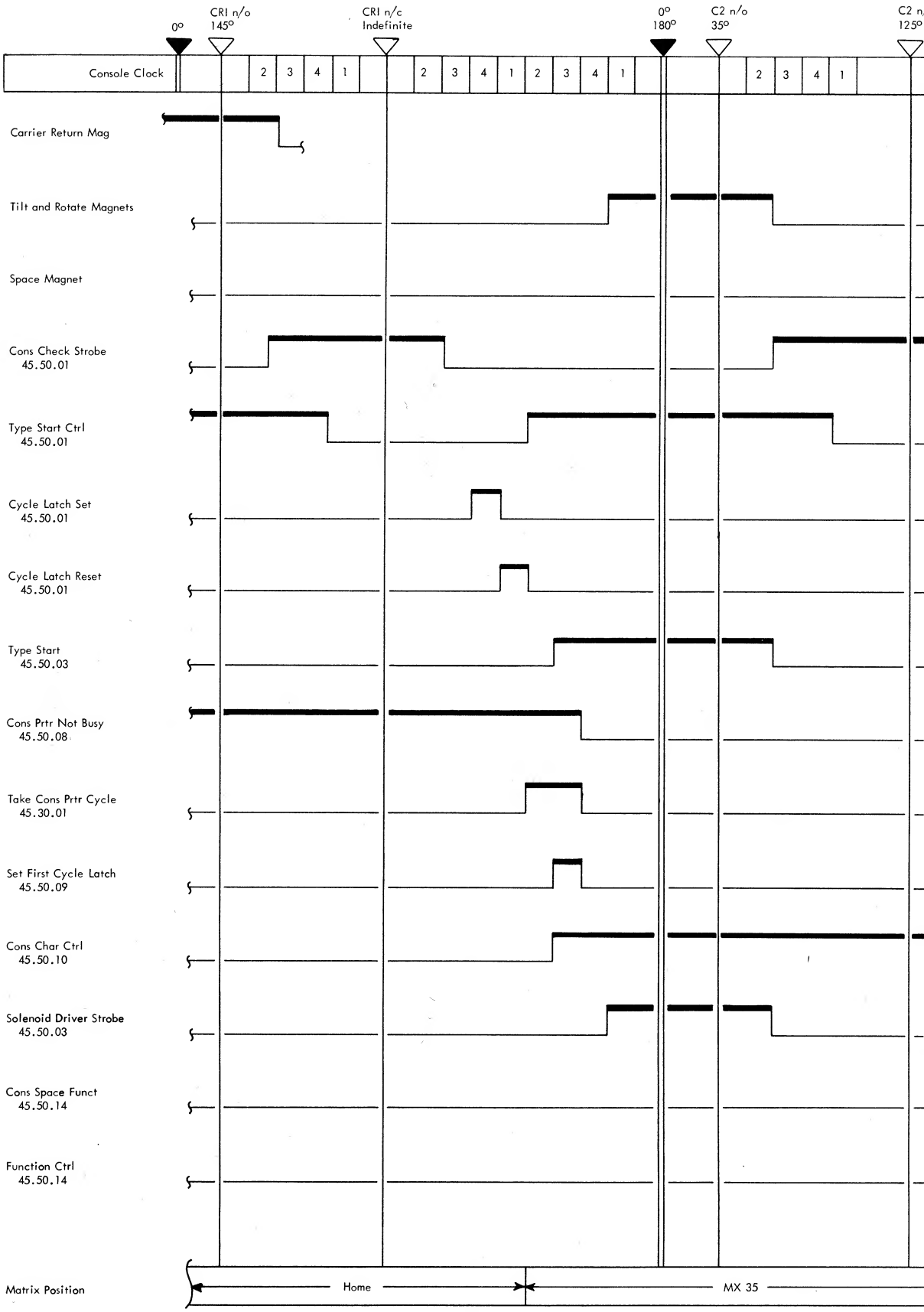
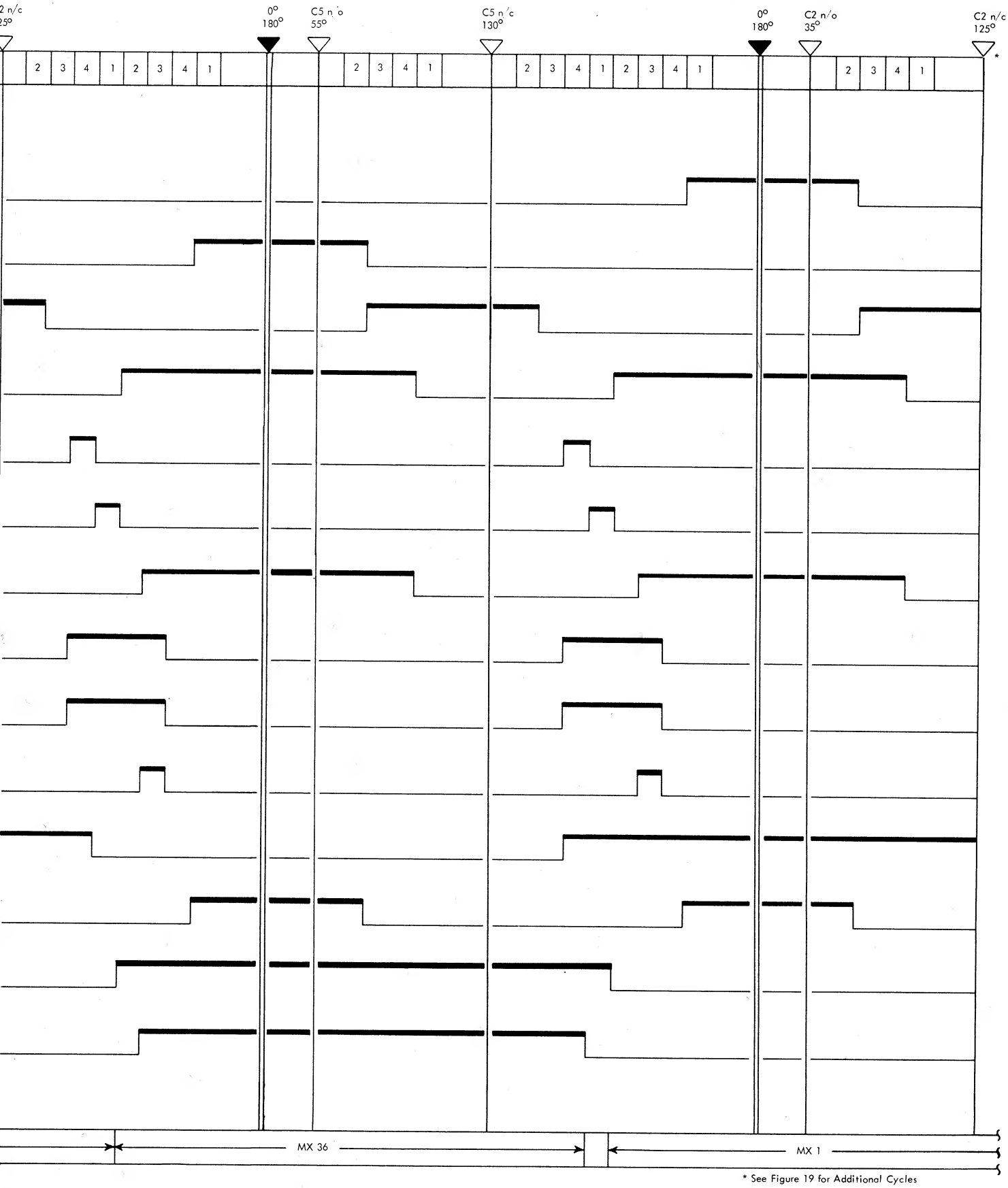


Figure 35. Stop Print-Out Start



* See Figure 19 for Additional Cycles

the AAR print-out; the Y-1 through Y-5 triggers gate the individual positions. MX12 (X-2, Y-6) causes another space operation. The matrix X-3 trigger controls the BAR print-out; the Y-1 through Y-5 triggers again gate the five positions. At MX18 (X-3, Y-6), another space operation occurs. The print-out progresses sequentially with matrix positions 19 through 27, gating their specific information as shown on Figure 33.

If the system has only one I-O channel, the matrix will step through positions 28 and 29 with no print cycles occurring. Matrix positions 28 or 29 prevent the take console printer cycle line from being brought up (2A—45.50.03). The console printer not busy latch stays on to gate the CC2 pulses that advance the matrix through MX29. In a two-channel overlapped system, the block at 2A (45.50.03) is not present and the Channel 2 unit select register will print out at MX28; the channel 2 unit number register, at MX29.

The MX29 (X-5, Y-5) position combines with the console stop print latch on to bring up the end stop data line. This line causes matrix position 34 (X-6, Y-4) to be gated on. MX34 initiates a carrier return operation. The next MX-Y drive pulse resets the Y-4 trigger, but the turn-on of the Y-5 trigger is prevented by the console op complete line that was brought up by MX34 position (1E—45.20.03). No Y-trigger on and the X-6 trigger on is matrix home position.

Matrix at home and the stop condition latch off combine to turn off the console stop print latch. With both the console stop print latch and the stop condition latch off, the console stop print complete line is brought up at 2E (44.10.02) to end the operation.

Address Set

The address set feature of the 1415 console permits an address to be entered into any address register in the 1411 by the console I-O printer. The console mode switch must be set to the "address set" position. The address entry switch (CE console) selects the desired address register.

The normal position of the address entry switch designates the IAR as the register to be altered and a B will print in the first printing position to identify this operation. When performing an IAR address set, all branch latches are reset and the no branch latch is set. This insures that the program will restart at the new IAR address keyed in by the operator. Six other settings of the address entry switch are provided to allow the operator to alter the contents of the AAR, BAR, CAR, DAR, EAR, or FAR. An address set of one of these registers causes a # to print in the first printing position.

OPERATION

The address set operation is shown in Figures 36 and 37. With the system stopped and the mode and address entry switches properly set, the operation is started by pressing the start key. If a stop print-out operation was initiated when the system stopped, the start key must be pressed after the print-out is completed. The clock stopped, stop print-out complete, and logic gate A or R, combine to bring up the stopped at cycle end line. The stopped at cycle end line up allows the start key line to turn on the console cycle start latch at CC3. Console cycle start on gates the selected address entry switch position to reset the address register with first clock pulse. At the next CC1 pulse, console cycle start brings up the console routine start line which turns on the address set routine latch. At CC2, console cycle start sets the MX-Y5 trigger which gates matrix position 35 on. Matrix position 35 and address set routine reset the console cycle start latch and initiate the print cycle for the identification character. A B or a # will print, depending on the position of the address entry switch.

When the console printer not busy latch is turned on at the end of the print cycle, the MX-Y6 trigger is set. MX-Y6 on advances the matrix to position 36, which initiates a space operation. When the space operation is completed, the MX-Y6 trigger on develops the MX-X drive line. The MX-X drive line up, MX-X6 trigger on, and the address set routine latch on set the MX-X1A trigger. The MX-Y drive line is also brought up to set the MX-Y1 trigger. The MX-X1A trigger on, MX-Y6 trigger off, and the address set routine latch on bring up the address set unlock line. This line unlocks the keyboard, allowing the operator to key in the new address.

The X-1A and Y-1 triggers on designate the matrix 1A, or first address set position. When the printer key is pressed, the first address character is printed. During this print cycle, the latch contacts are decoded into BCD code and the character is gated to the ten-thousands position of the selected address register. At 35 degrees of the print cycle, console printer strobe and the MX-X1A trigger on, bring up the console MX address drive line at CC4 (4G—45.20.01). The console MX address drive line advances the matrix to the 2A (X-1A, Y-2) position. The next character keyed in will print and enter the thousands position of the address register. At the completion of this print cycle, the matrix has advanced to the 3A position. This operation continues until the fifth character keyed in, prints and enters the units position of the address register at matrix position 5A.

Matrix position 5A (X-1A, Y-5) and the console printer strobe reset the address set routine latch at CC3. The address set routine latch off, locks the keyboard,

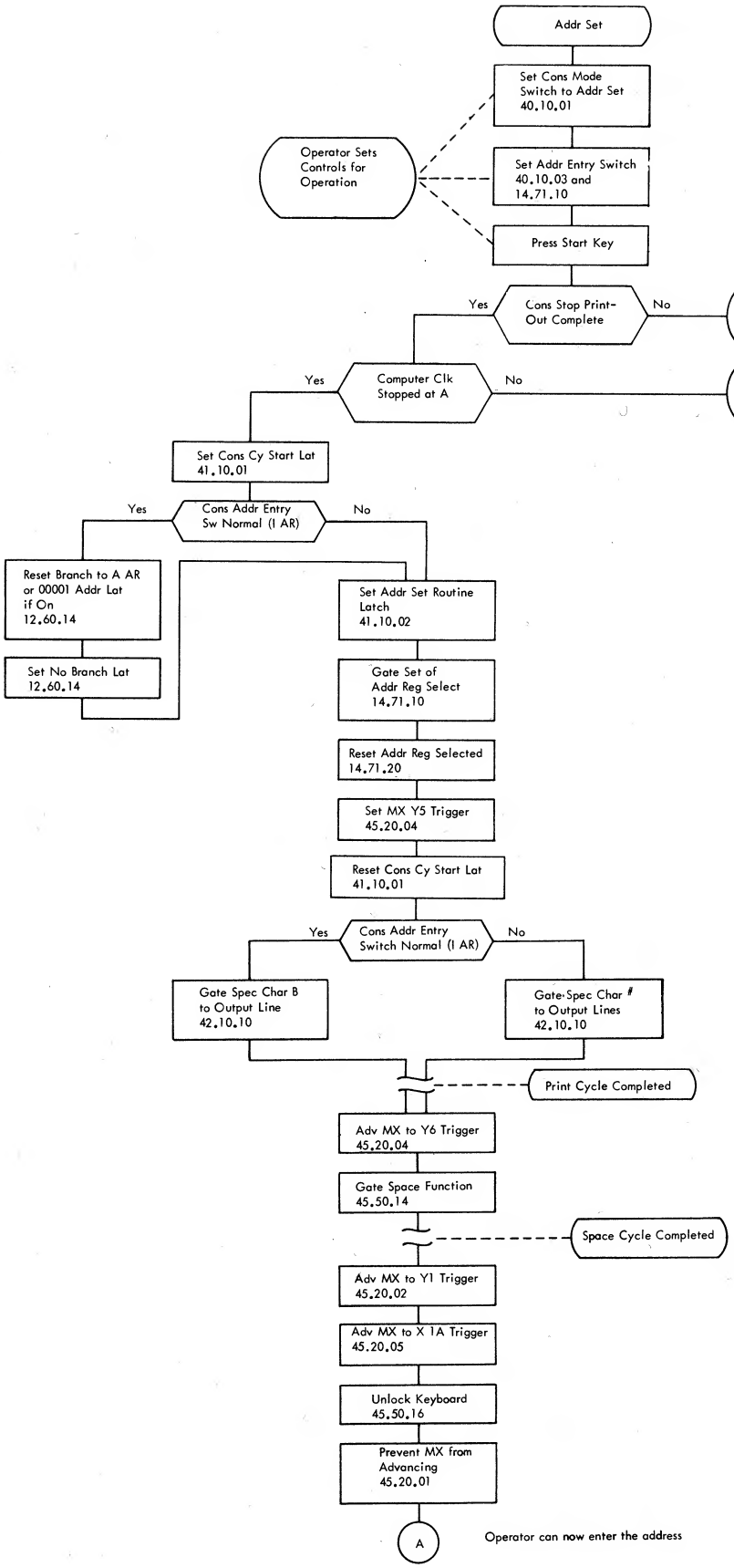


Figure 36. Address Set Operation (Sheet 1 of 2)

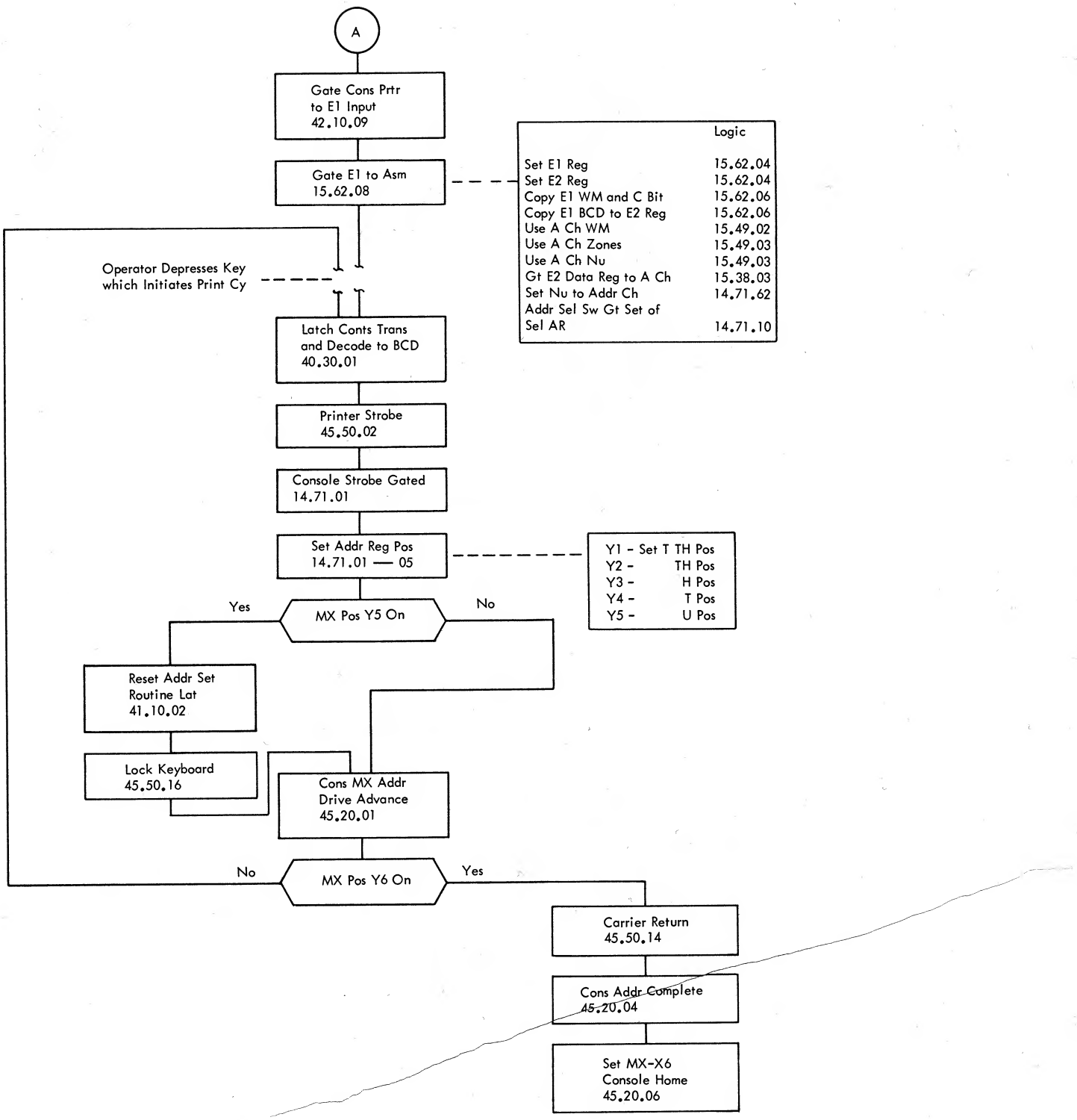


Figure 36. Address Set Operation (Sheet 2 of 2)

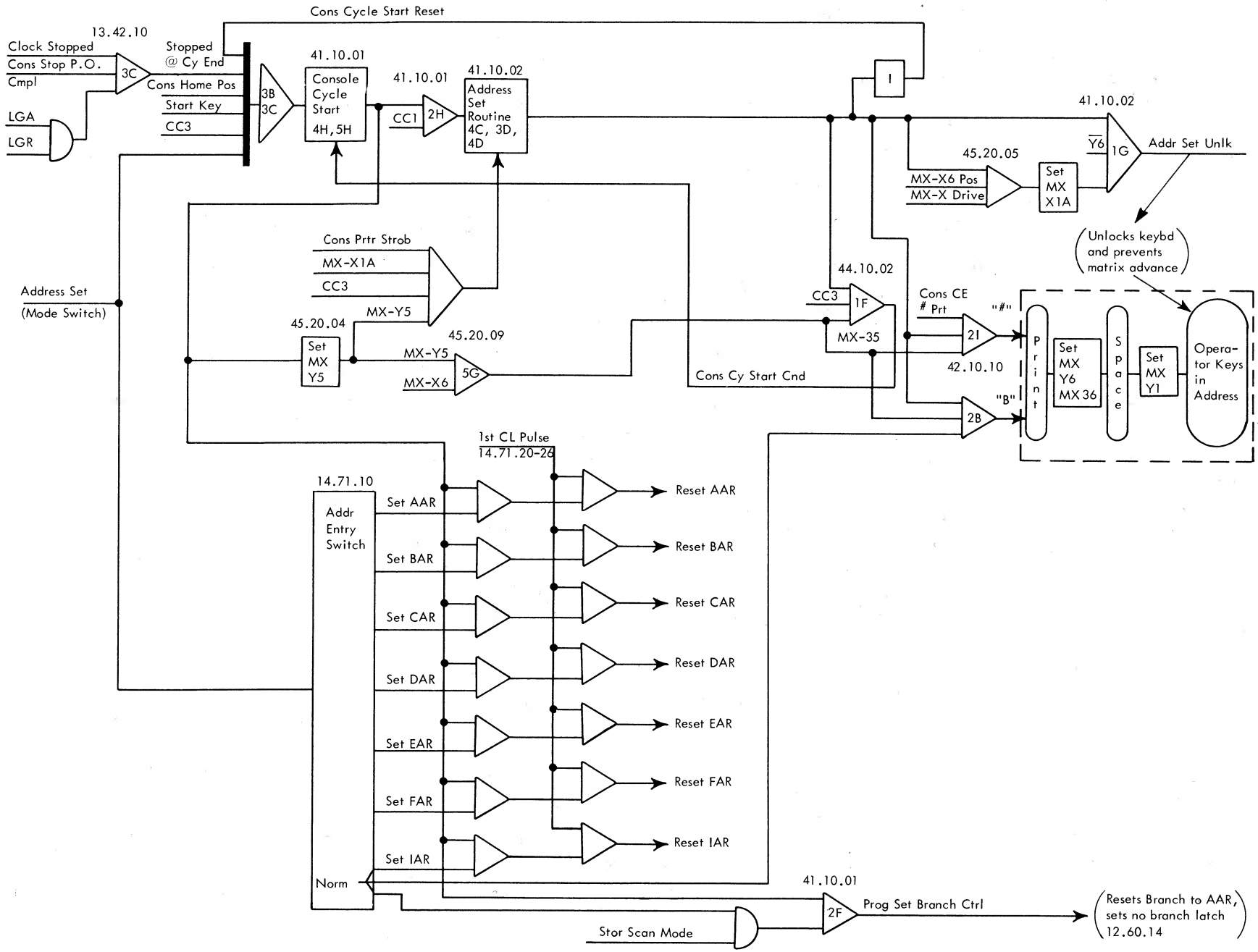


Figure 37. Address Set Start

allowing the matrix to be advanced to the 6A (X1A, Y-6) position through normal MX-Y drive. Matrix position 6A initiates a carrier return-index operation.

Matrix triggers X-1A and Y-6 on, combine with the address set routine latch off to bring up the console address complete line on 45.20.04. When the carrier return operation is completed, the MX-Y drive line up and the console address complete line up, turn off the MX-X1A trigger. The console address complete line also develops the address set complete line, which sets the MX-X6 trigger, returning the matrix to the home position.

No error detection is performed during an address set operation because the CPU is stopped and none of the error circuits is sampled.

Display

The display routine allows the data in any portion of 1411 memory to be printed out on the console I-O printer. The display starts with the character at the address keyed in by the operator. The display progresses through storage in the reverse scan (+1) direction. The length of the display may be as short as two characters or may extend for many typed lines of characters.

With the mode switch set to "display" and the system stopped, a display may be started by pressing the start key. The printer will print the special character D in the first printing position and space over the second position. At the completion of the space cycle, the keyboard will unlock to allow the operator to enter the high-order address of the information to be displayed (a CAR address set operation). After the last address character has been entered, a carrier return-index operation is performed. On the new line, a D is again printed in the first printing position, followed by a space operation. The actual display now begins with the printing out of the character at the specified address. The address is modified by +1 and the next higher character in memory is printed out. This operation continues until the display is either interrupted or terminated. After the first character, the operation is interrupted by the display of any character containing a word-mark bit. An interruption only stops the display; it may be continued by again pressing the start key. When the stop key is pressed, the display is terminated.

OPERATION

The display operation is shown in Figures 38 and 39. If a stop print-out was initiated when the system stopped, it must be completed before the start key is pressed. With the console matrix at home position and the stopped at last execute cycle line up, the start key line turns on the console cycle start latch at CC3. The console cycle start latch on, allows the MX-Y5 trigger to set,

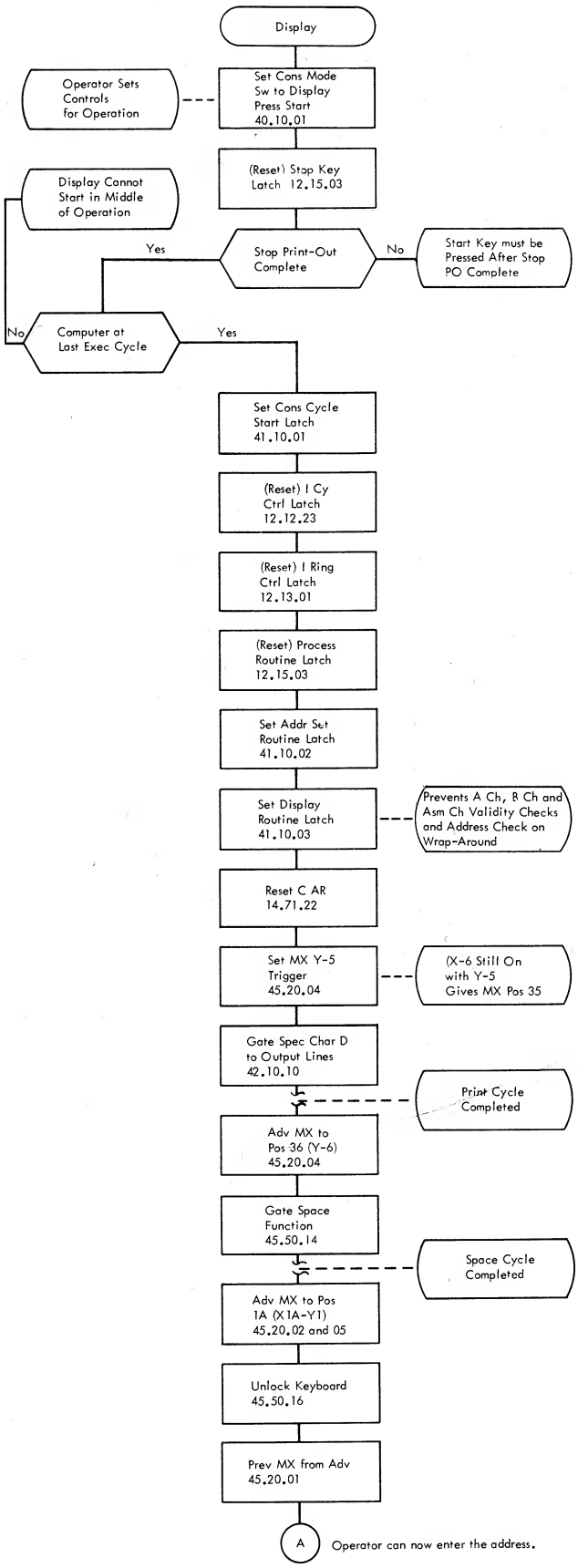


Figure 38. Display Operation (Sheet 1 of 3)

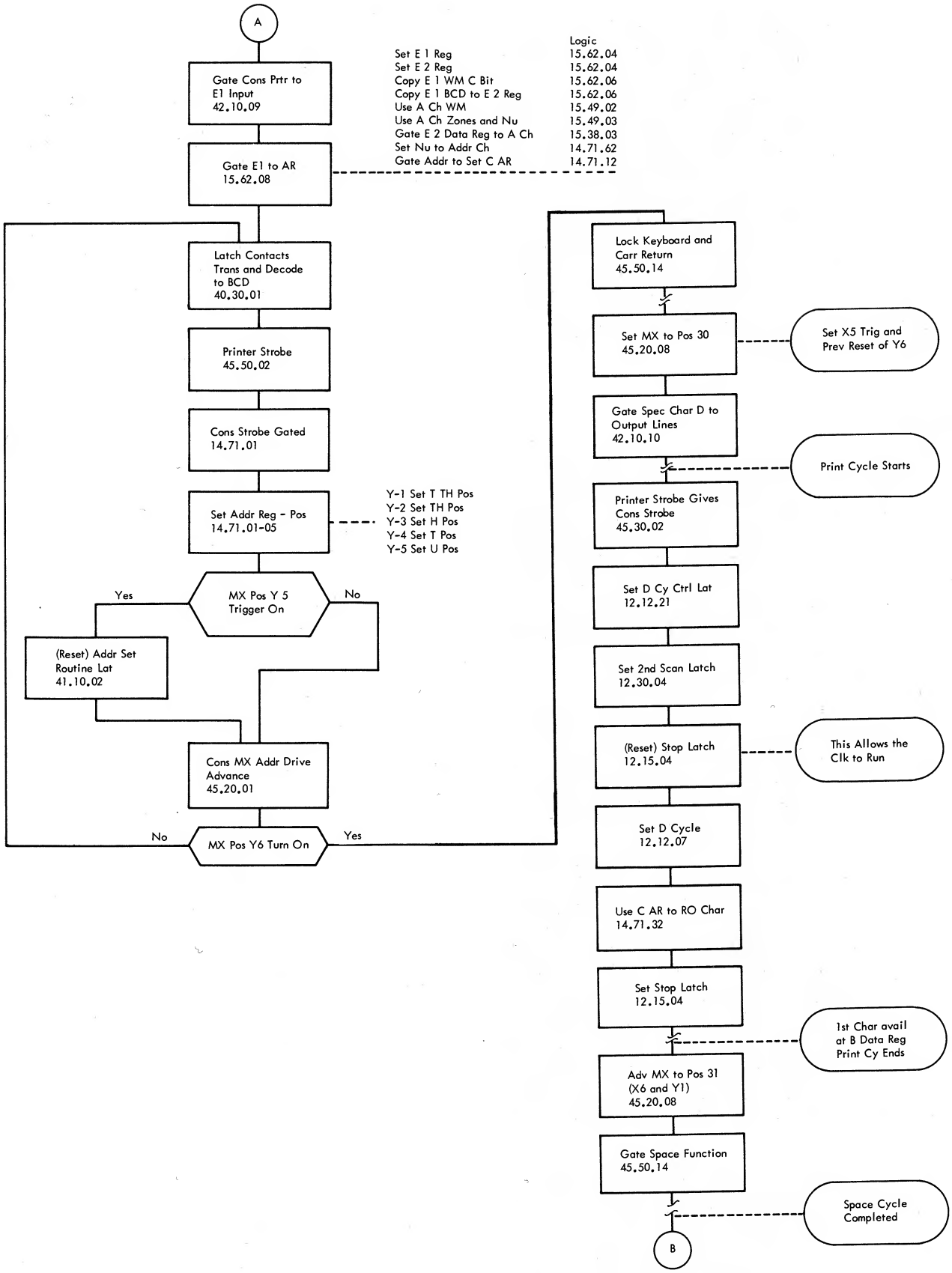


Figure 38. Display Operation (Sheet 2 of 3)

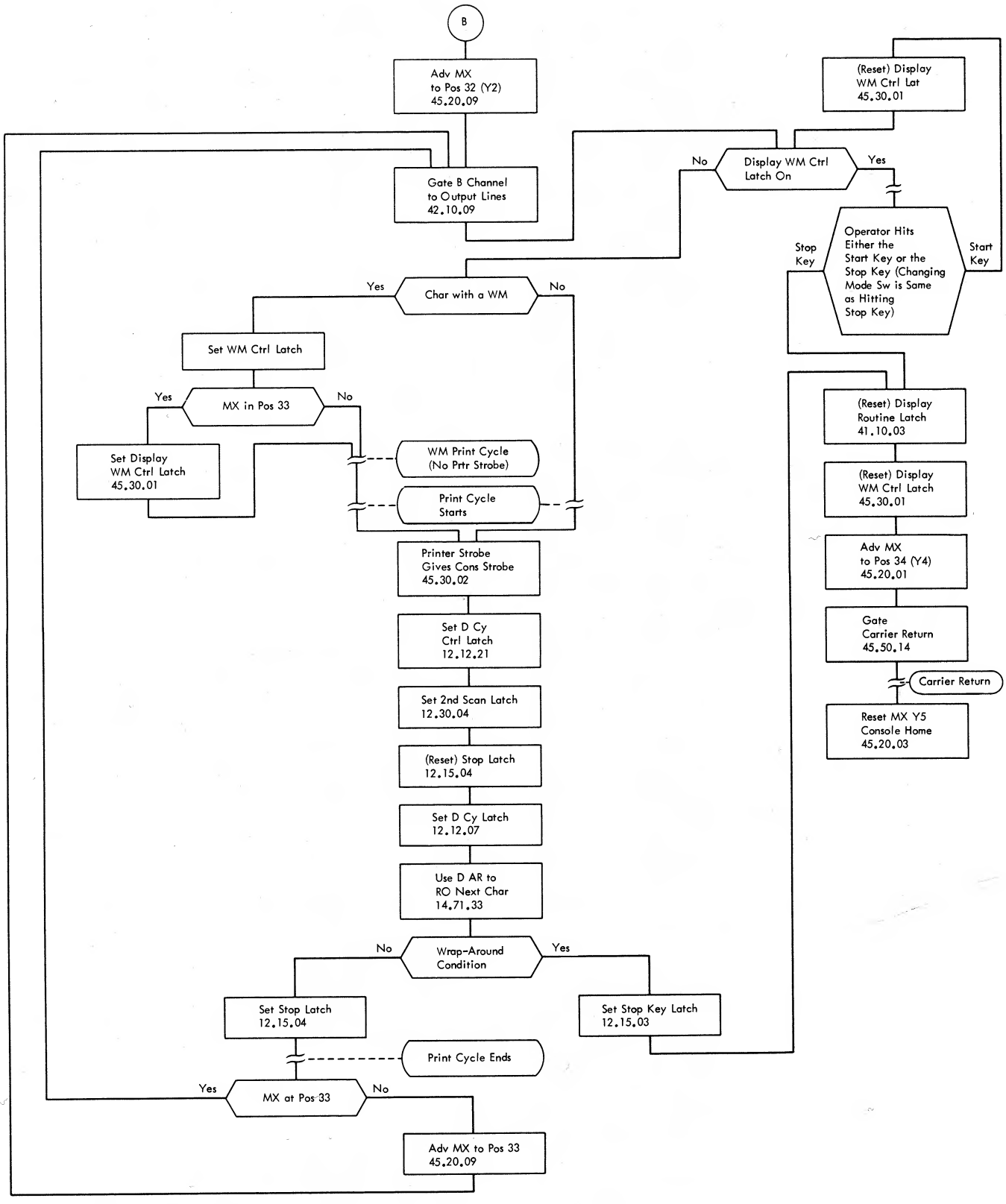


Figure 38. Display Operation (Sheet 3 of 3)

which advances the matrix to position 35. At the next CC1 pulse, the console routine start line is brought up, which turns on the address set routine latch and the display routine latch. The display routine latch on AND's with MX35 to bring up the special character D line. The output bits for the D character cause a print cycle which prints the identification character in the first printing position. Normal matrix advance sets the MX-Y6 trigger, advancing the matrix to position 36 which initiates a space cycle. After the space cycle, MX-X drive AND's with MX-X6 trigger on and the address set routine latch on to set the MX-X1A trigger. Normal MX-Y drive sets the MX-Y1 trigger. The MX-X6 trigger off, MX-X-1A trigger on, and the address set routine latch on, combine at 1G on 41.10.02 to bring up the address set unlock line. This line unlocks the keyboard (45.50.16) which prevents any further matrix advance until the starting address is keyed in.

The address set operation, which determines the location of the first character to be displayed, operates the same as described in the section "Address Set." The address enters the CAR. The CAR was reset by the address set routine latch on, display routine latch on, and console cycle start latch on. The matrix advances from position 1A (X-1A, Y-1) through position 5A (X-1A, Y-5) while the TTH, TH, H, T, and U positions of the address are entered into the CAR. The matrix is then advanced to position 6A which initiates a carrier return-index operation. Figure 40 shows how display routine causes MX position 30 to be gated on at the completion of the address set portion of the operation.

Matrix position 30 causes a D to print in the first printing position of the new line (2D—42.10.10). While the D is being printed, a console strobe pulse is sent to the 1411 to start the CPU clock and cause a D cycle to be taken. The address that was entered into the CAR is read into STAR. It is modified with second scan latch on (+1) and stored in the DAR. STAR addresses the character in memory, reading it into the B data register and on the B channel.

At the completion of the D print cycle, the matrix is at position 31, which initiates a space cycle. Following the space cycle, the matrix is advanced to position 32. MX32 position gates the B channel character to the console output lines (5C—42.10.09), which causes the character to be printed. During this print cycle, another console strobe pulse is sent to the 1411 and another D cycle is taken. The address in DAR is read into STAR, modified by +1, and stored back in the DAR. STAR addresses the next character in memory, reading it into the B data register and on the B channel. After the first character has printed, the matrix has advanced to position 33. MX33 position gates the character on the B channel to the console and the second character is printed. During the print cycle, another D cycle is taken and STAR now addresses the third character which is read on the B channel. Each character prints out in a similar manner. The matrix will now remain in position 33 until the display operation is terminated.

With the exception of the first character displayed (MX32), any character containing a word-mark bit will interrupt the display. When a character with a word-mark bit is sensed with the matrix at position 33, the display will stop after the character is printed. Console MX33 allows the display word-mark control latch to be turned on (45.30.01) when the B channel WM bit is sensed. The word mark and the character are printed and the next D cycle is taken but no further printing can occur. The display WM control latch on prevents the take console printer cycle line from coming up at 2D on 45.30.01.

The display may be continued by pressing the start key which resets the display WM control latch, allowing the console printer cycle to be taken. The display will be interrupted again if another B channel WM bit is sensed. When the end of a line is reached during a display, a carrier return-index operation is performed and the display continues on the new line.

If the stop key is pressed or the mode switch is moved, the display will be terminated. The stop key latch resets the display routine latch (3C, 2C—41.10.03) at CC1. The display WM control latch is also reset if it is on. MX-X6 on, MX-Y3 on, display routine latch off, and alter routine latch off combine on 45.20.03 to set the MX-Y4 trigger. The MX-Y4 and MX-X6 triggers on gate matrix position 34 on, which initiates a carrier return-index operation. The MX-Y drive line then comes up to turn off the MX-Y4 trigger. With only the MX-X6 trigger on, the matrix is at home position which ends the operation.

A channel, B channel, and assembly channel errors are blocked during a display operation. Address check is also blocked when wrap-around occurs. Other errors will halt the display (5E—45.30.01). They may be cleared by resetting or by pressing the start key while in one of the run modes. Error print-outs cannot occur when the display routine latch is on (5E—44.10.01).

Alter

The alter routine allows the operator to change the data in any portion of memory if that portion of memory has been previously displayed. The display routine that must precede the alter routine is the same as described under "Display." The number of characters that the operator may alter during each alter operation depends on how the previous display was terminated.

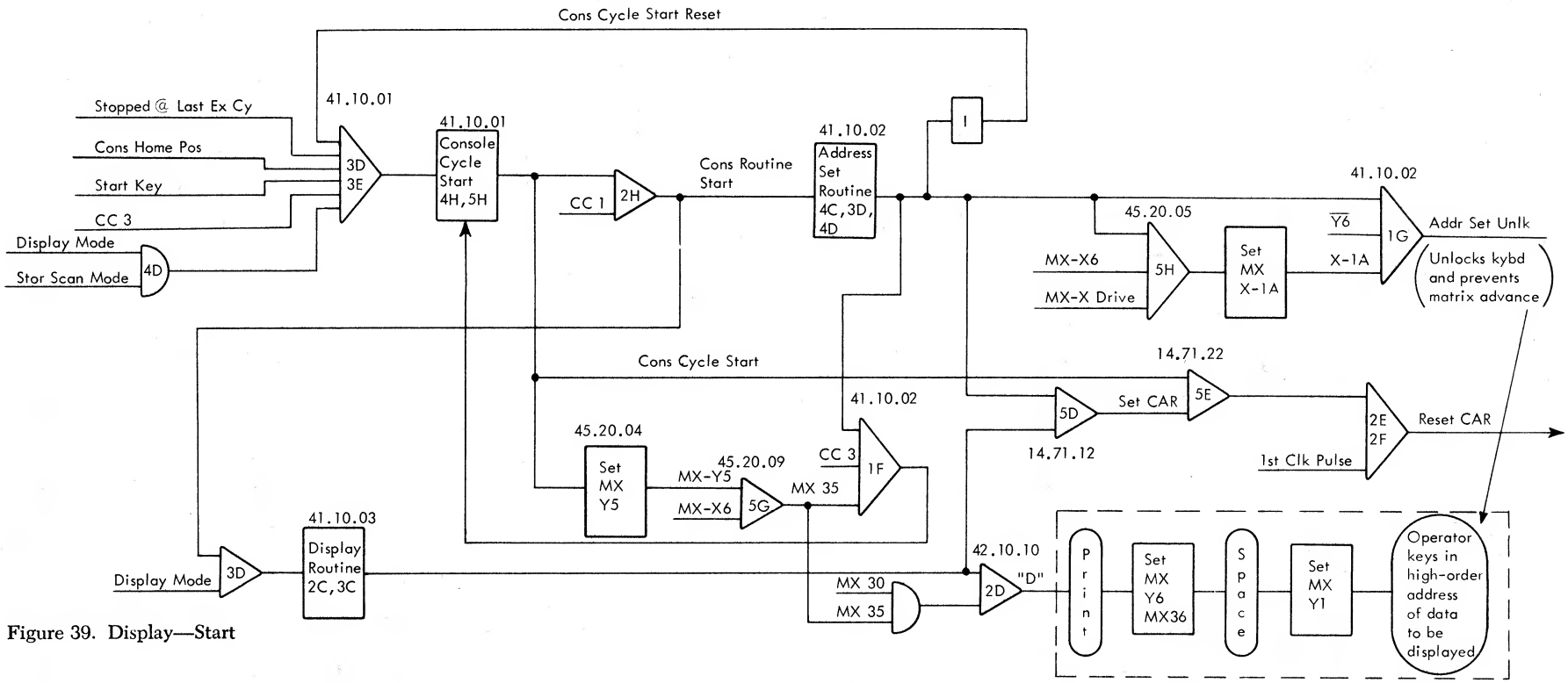


Figure 39. Display—Start

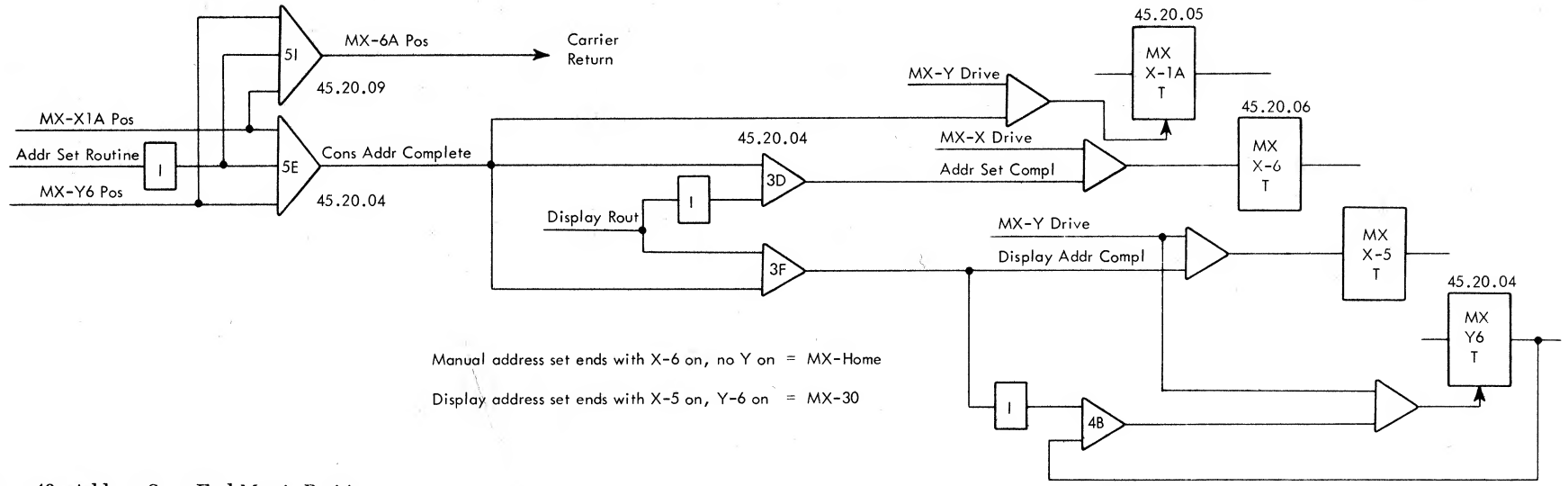


Figure 40. Address Set—End Matrix Position

During the display, the first B channel word-mark bit encountered (while in MX33 position) will set the word-mark condition alter latch. If the display continues for a full line, the full line condition alter latch is set and the WM condition alter latch, if on, is reset. The condition alter latch that is on, remains on until the alter operation ends or an operation other than alter is started.

If the display ends with the WM condition alter latch on, the operator may alter up to, but not including, the character that caused the latch to be on. If the display ends with the full line condition alter latch on, the operator may alter the full line that was displayed. If neither condition alter latch is set on (displayed data had no word marks and did not extend for a full line), the alter operation cannot be performed.

OPERATION

The alter operation is started by setting the mode switch to the alter position and pressing the start key (Figures 41 and 42). Alter mode and either the WM condition alter latch or the full line condition alter latch on, allow the alter routine line to come up. The alter routine line AND's with the start key line and console home position to bring up the console alter MX gate line which turns on the matrix gate latch. The matrix gate latch on gates the matrix to position 30. Alter routine AND's with MX30 position to bring up the special character A, C, E, I line, causing the identification print cycle to occur. An A is printed in the first printing position. Normal matrix advance brings up matrix position 31 which initiates a space cycle. The matrix is then advanced to position 32 which AND's with alter routine to bring up the alter keyboard unlock line. This line unlocks the keyboard, allowing the operator to key in data.

Alter routine and MX positions 32 and 33 allow the necessary lines to be brought up to gate the data to the A channel, through the assembly, to memory. While keying in and printing the first character, a console strobe pulse is sent to the 1411. This pulse sets the controls to start the CPU clock and initiate two consecutive D cycles. During the first D cycle, the address in CAR (entered at the start of the display routine) is read into STAR. The address is modified by +1 and stored in DAR. STAR addresses the first character to be altered. The character is read into the B data register and on the B channel while the new character is entered into the same memory location. If there is a B channel word-mark bit, it has no effect on the operation because the matrix is in position 32.

During the second D cycle (a look-ahead cycle), the address in DAR is read into STAR. The address is modified by zero and restored in DAR. STAR now addresses the second character which is read into the B-data register and on the B channel. At the end of the second D cycle, the CPU clock stops and the matrix is now in position 33. The first character of the field is now altered. The second character is on the B channel. The alter operation can continue in a similar manner as long as the alter routine line stays up. The matrix will remain in position 33 causing all subsequent D cycles to use the DAR. Each character that is keyed in will initiate the two D cycles. The first D cycle replaces the character in memory with the character that is keyed in. The second D cycle is used to read out the next character in memory to check for a word-mark bit.

If the WM condition alter latch is on, the first B channel word-mark bit encountered while in MX33 position will reset this latch. With the WM condition alter latch off, the alter routine line will drop and lock the keyboard. If the full line condition alter latch was on from the display operation, characters may be altered until the console printer end-of-line line is brought up. This line resets the full line condition alter latch which will drop the alter routine line.

When the alter routine line is dropped, the MX-Y4 trigger is gated on (5C, 5D—45.20.03), which brings up MX34 position. MX34 initiates a carrier return-index operation and the matrix is then gated to the home position to end the operation.

The alter routine may be terminated at any time by rotating the mode switch out of the alter mode or by pressing the stop key. A channel, B channel, and assembly channel errors are blocked during an alter operation. Address check is also blocked when wrap-around occurs. Any other error will end the operation and no print-out will occur.

If a mistake is made while keying in characters, it is possible to re-alter the same field without performing another display. By pressing the stop key before the alter operation is completed, the alter routine line will be dropped and a carrier return-index operation will be executed. Because either the WM condition alter latch or the full line condition alter latch is still on, the same starting condition will remain.

I/E Mode

The I/E position of the mode switch permits the CE or the customer to follow a program through the system. The first depression of the start key causes the machine to read one complete instruction from memory and then stop. The next depression of the start key causes the machine to execute the instruction and stop. Subsequent operation of the start key results in the machine taking alternate instruction and execute cycles.

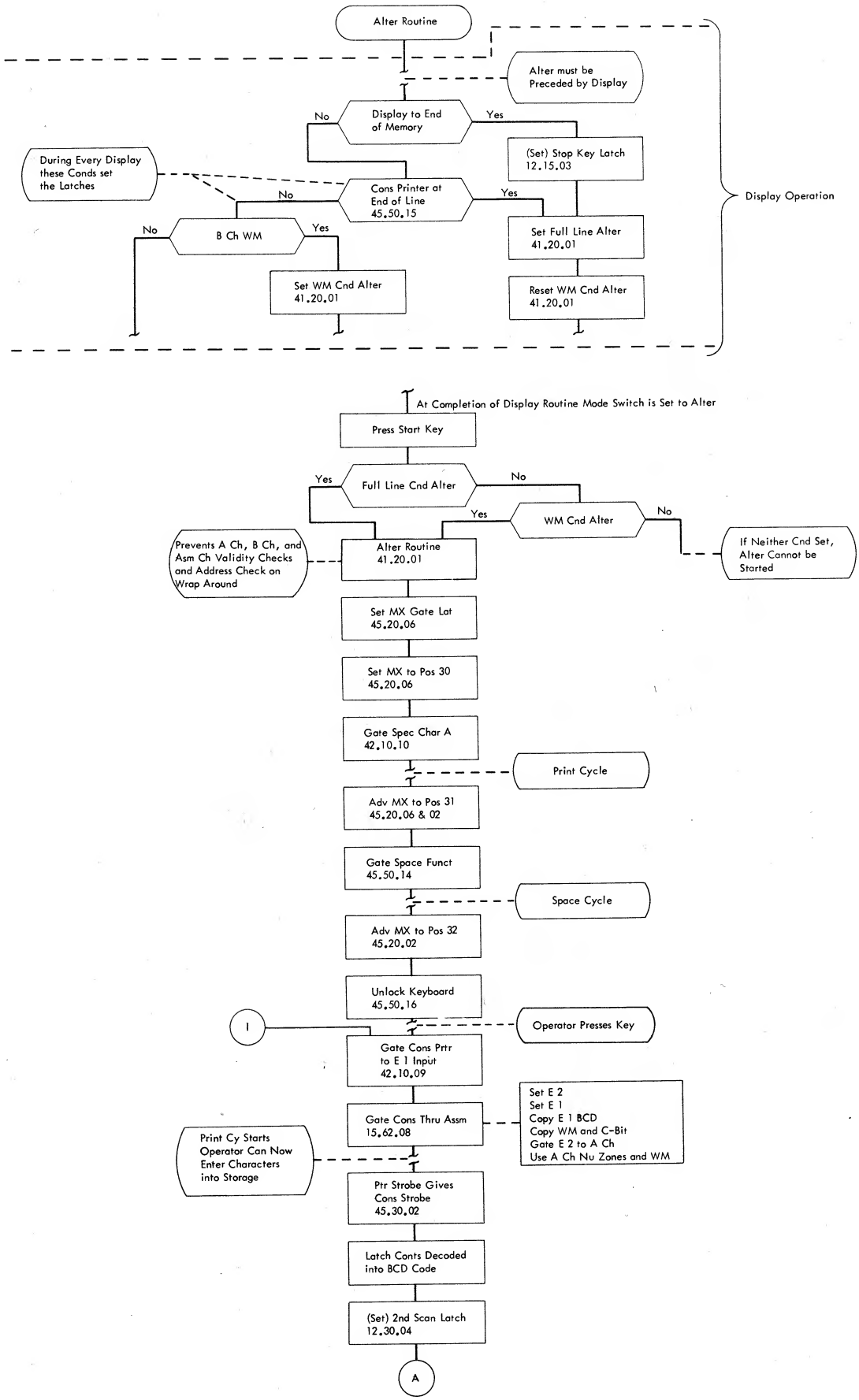


Figure 41. Alter Routine (Sheet 1 of 2)

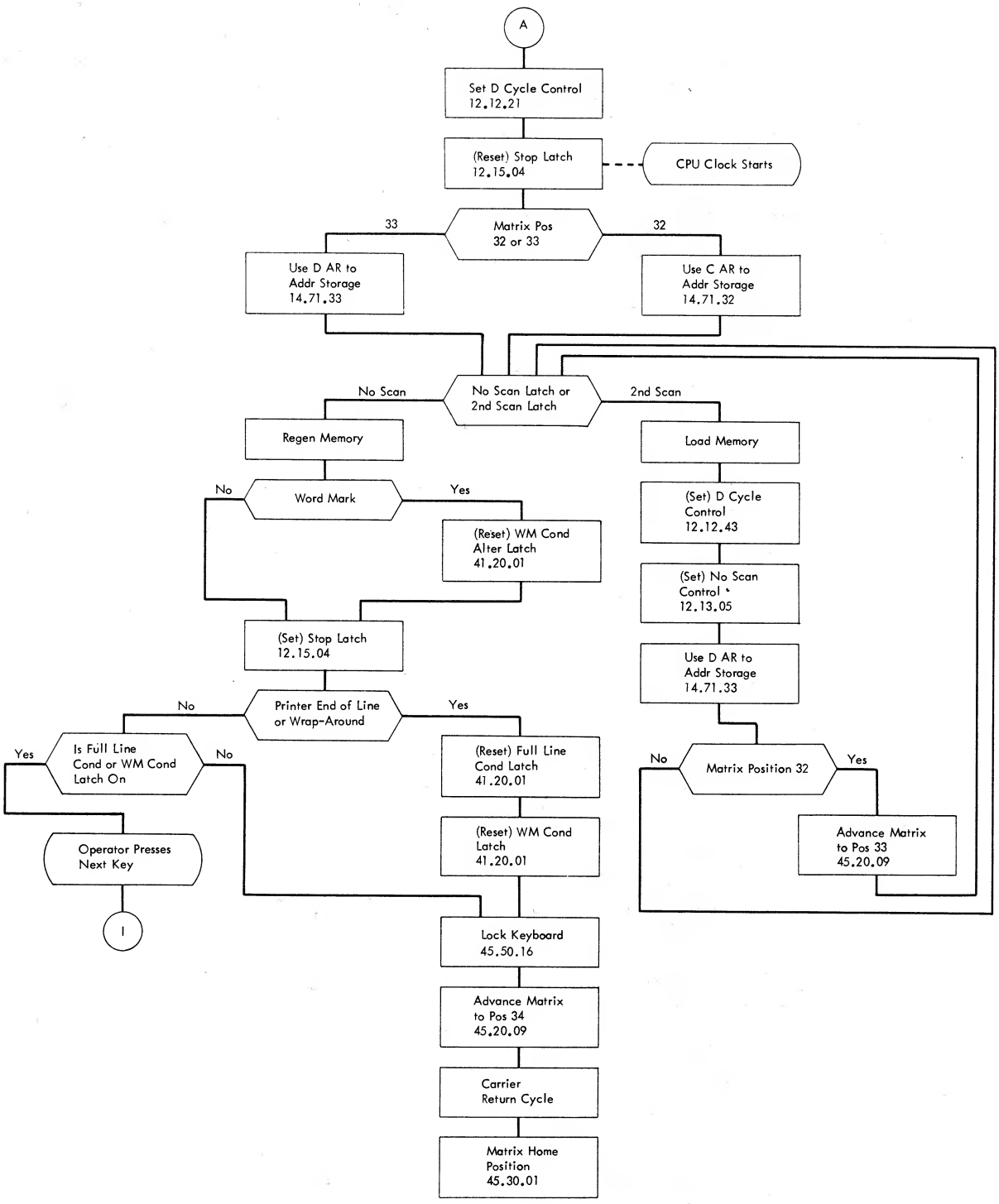


Figure 41. Alter Routine (Sheet 2 of 2)

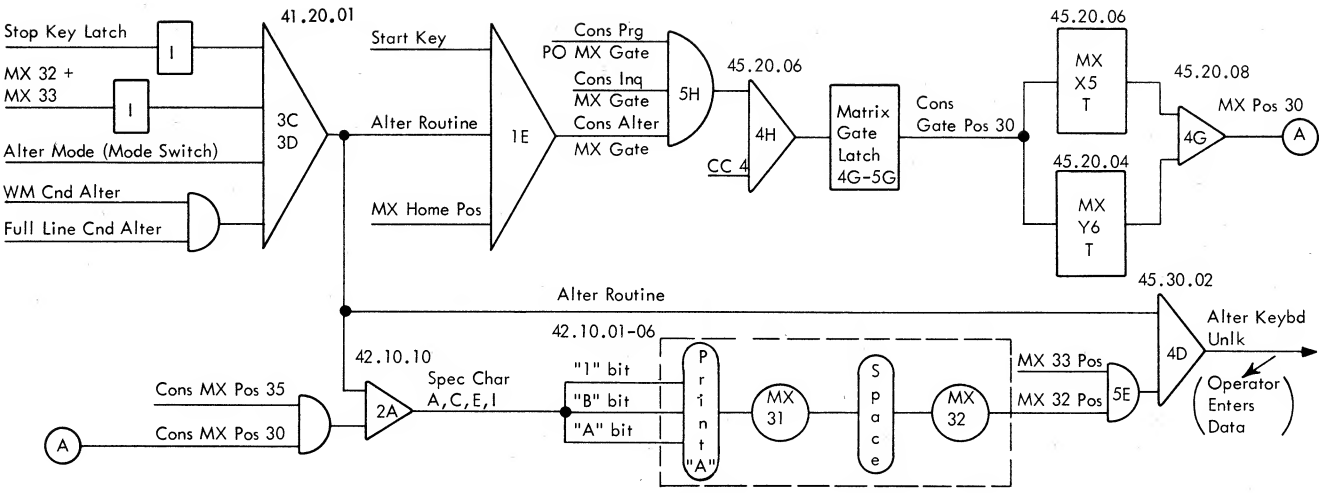


Figure 42. Alter—Start

The console mode switch in the I/E position gates every last instruction RO cycle and last execute cycle to set the stop latch (4C, 5C—12.15.04). If the print-out control switch is in the NORMAL position, a stop print-out will occur after every cycle. The stop print-out prints a C in the identification character position. The I/E position of the mode switch AND's with the console stop print latch on, to bring up the console cycle stop line (44.10.02). This line develops the special character C line on 42.10.10.

CE Mode

The CE position of the mode switch makes the storage scan feature operable. This feature allows the CE or customer to load or regenerate data in memory manually. The storage scan operation is covered in the section entitled "1415 CE Console."

Inquiry

The inquiry operation allows the operator to communicate with the system through the use of pre-entered program instructions. The operator keys in inquiry messages which enter the system in an unbuffered manner under the control of read console printer instructions. The replies are sent to the printer in the form of programmed print-outs that are set up by write console printer instructions. Three keys are provided on the printer to control inquiry operations.

REQUEST KEY

A console inquiry is initiated by pressing the inquiry request key on the 1-0 printer. This action closes the N/O request key contact which turns on the inquiry request latch. The program being used must be set up to test for a conditional branch on inquiry [J (I) Q]. If the inquiry request latch is off when the conditional branch instruction is executed, the program will continue on without branching. If the inquiry request latch is on, the program branches to a location where the programmer has stored a read console printer instruction M/L (% T0) (B) R. This instruction causes the identification character to be printed and unlocks the keyboard so the operator can key data into the storage area designated by the B address.

RELEASE KEY

In the program being used, the correct length of the B field of the M/L (% T0) (B) R instruction will be set by placing a group mark-word mark (GM-WM) in the next higher storage location. After the proper number of characters are keyed in, the inquiry release key is pressed. This action closes the N/O inquiry release contact to signal the end of the inquiry message. The system will read out the next character in storage (which

should be the GM-WM) to obtain a correct length record check. Pressing the release key also locks the keyboard, causes a carrier return, and turns off the inquiry request latch.

CANCEL KEY

If the operator wishes to cancel the inquiry because of an error or some other reason, he may press the inquiry cancel key. The cancel key causes the same functional operations as the release key except that the condition latch is turned on. The program may then test the condition indicator to determine that a cancel took place.

Read Console Printer—M/L (% T0) (B) R

The read console printer instruction allows the I-O printer to be used for entering data into the system. Usual programming employs an inquiry branch instruction to recognize an inquiry request and cause the program to branch to a read console printer instruction. If a read console printer instruction is encountered without an inquiry request having been made, the instruction is not executed.

The execution of the read instruction begins with the printing of the identification character I in the first printing position. A normal output space operation follows and then the keyboard is unlocked to allow characters to be keyed in. The first character entered is sent to the B-field address of the read instruction. Subsequent characters are placed in next higher storage positions. After the last character is keyed in, the inquiry release key is pressed. The GM-WM that was placed in the next higher position is read out at this time, correct length record is signaled, and the program is advanced to the next instruction.

OPERATION (Figure 43)

When an M/L %T0 (B) R instruction is given, the select unit T line is brought up to select the console. The E channel status indicators are reset. If a read console printer instruction is given without the console inquiry request latch on, the E channel status sample A pulse turns on the no-transfer status latch, a last execute cycle is signaled, and the program moves to the next instruction.

If the console inquiry request latch is on and no status latches are on, the select unit T line turns on the read op interlock latch. This latch brings up the console read op line. If the operation is M, the console move read op line is also brought up.

The console read op line develops the console inquiry MX gate line on 41.30.02. This line turns on the matrix gate latch (45.20.06) which gates on matrix position 30. Console read op line and MX30 combine on 42.10.10 to bring up the special character I which prints to identify the operation as an inquiry. The matrix is then advanced to MX31 which initiates an output space operation. At the completion of the space operation, the matrix steps to position 32. Console read op line and MX32 combine on 41.30.02 to bring up the inquiry keyboard unlock line which allows the operator to key in characters. The matrix remains in position 32 while the data are being keyed in.

The console read op line brings up the gate console printer to E1 in line. The console printer strobe pulse that accompanies each character causes the CPU to set the BCD data in the E1 registers and take E cycles to set the characters in storage. Each character is gated from E2 to the A channel and to assembly. The BAR is modified by plus one during the store cycle. If the read instruction is in load mode, the operator may enter word marks as described in "Word-Mark Control—Input." If the operation is in move mode, word marks cannot be printed or entered into storage because the move read op blocks the set of the WM control latch and the WM input latch.

After the operator has entered the exact number of characters for the B field, the inquiry release key should be pressed. This action turns on the external end of transfer trigger. Another E cycle is taken and the next character to read out from storage should be the GM-WM. The GM-WM turns on the end of record latch which turns on the internal end of transfer latch. The GM-WM is read back into storage to retain the same B field length. At this time a check is made for correct or wrong length record. Not E2 register full, not E channel strobe trigger, and the end of record latch on turn on the correct length record latch.

The external end of transfer trigger on brings up the E channel status sample B line on 13.65.05. The E channel in process line is deactivated and turns off the read op interlock latch. This latch off causes the console read op line to go down and the keyboard to lock. The printer locked condition proceed line is brought up with the keyboard locked and allows the matrix to advance. The matrix steps through position 33 and then position 34 when a carrier return is initiated. The matrix home position is then gated on.

If the operator presses the release key before entering the proper number of characters, the operation is completed but the wrong length record latch is turned on. The release key turns on the external end of transfer latch and the last input cycle turns on the internal end of transfer latch. However, the end of record latch is not turned on. E2 not full, E channel strobe off, and the end of record latch off, turn on the wrong length record latch (Figure 43, Sheet 2).

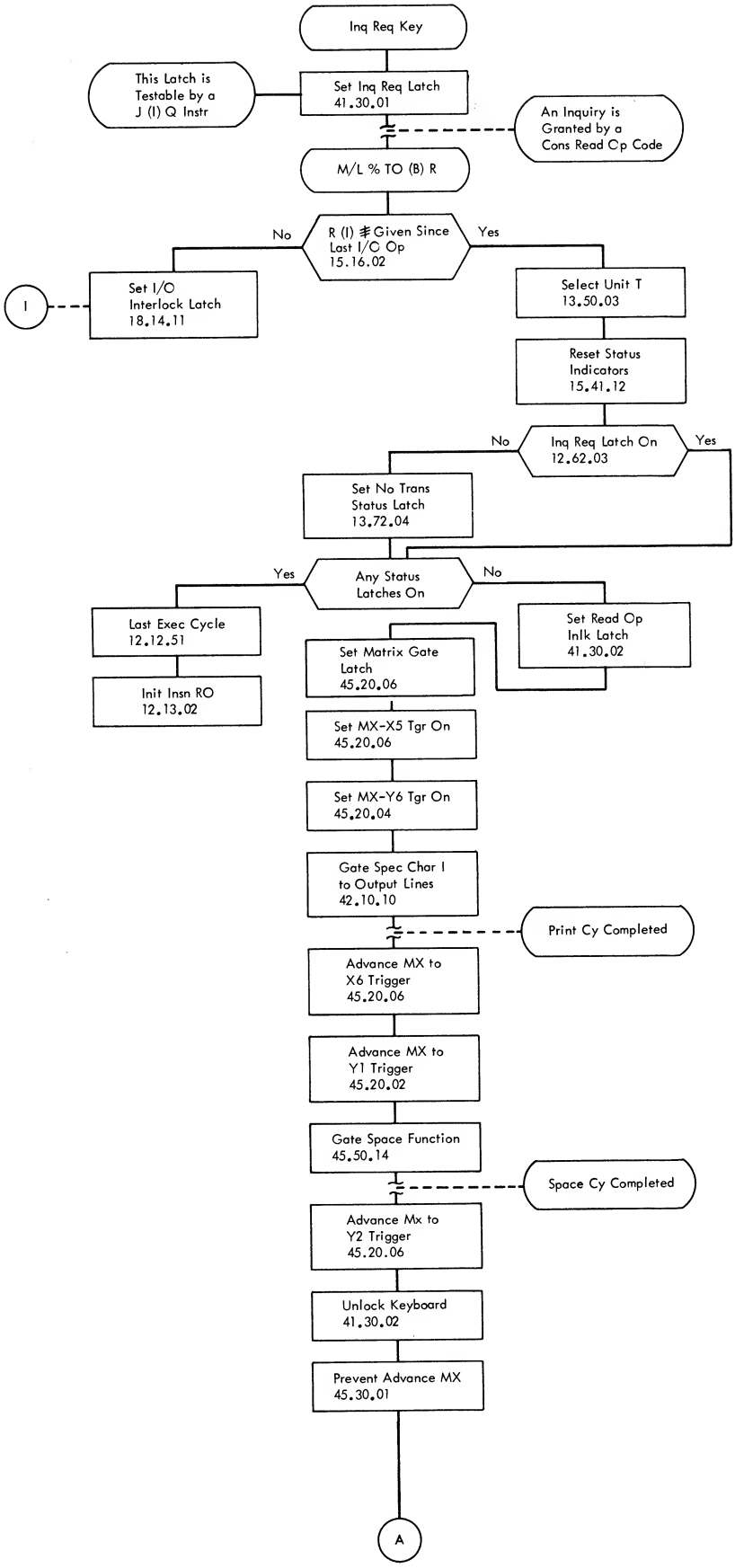


Figure 43. Inquiry Request and I-O Printer Read (Sheet 1 of 3)

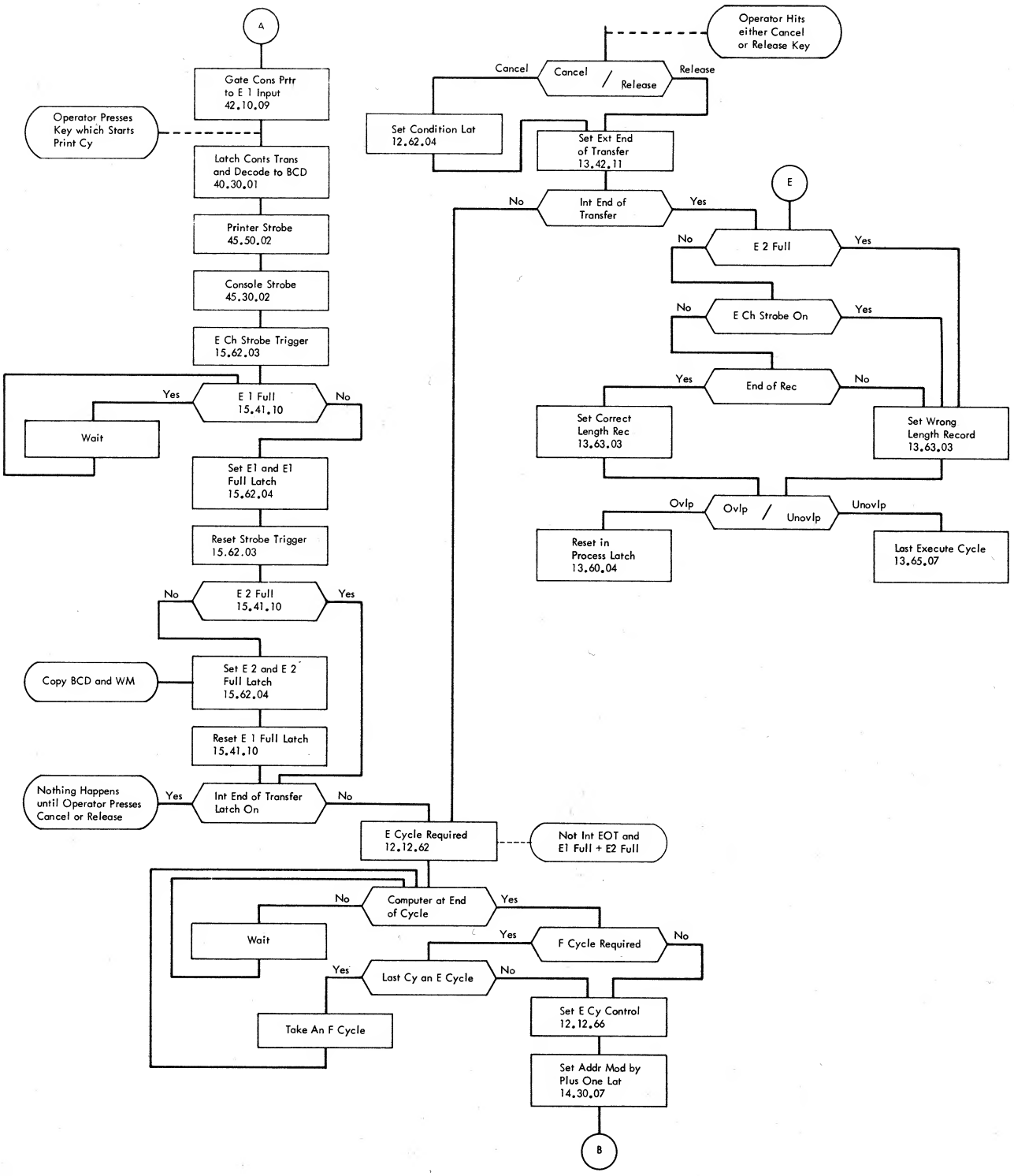


Figure 43. Inquiry Request and I-O Printer Read (Sheet 2 of 3)

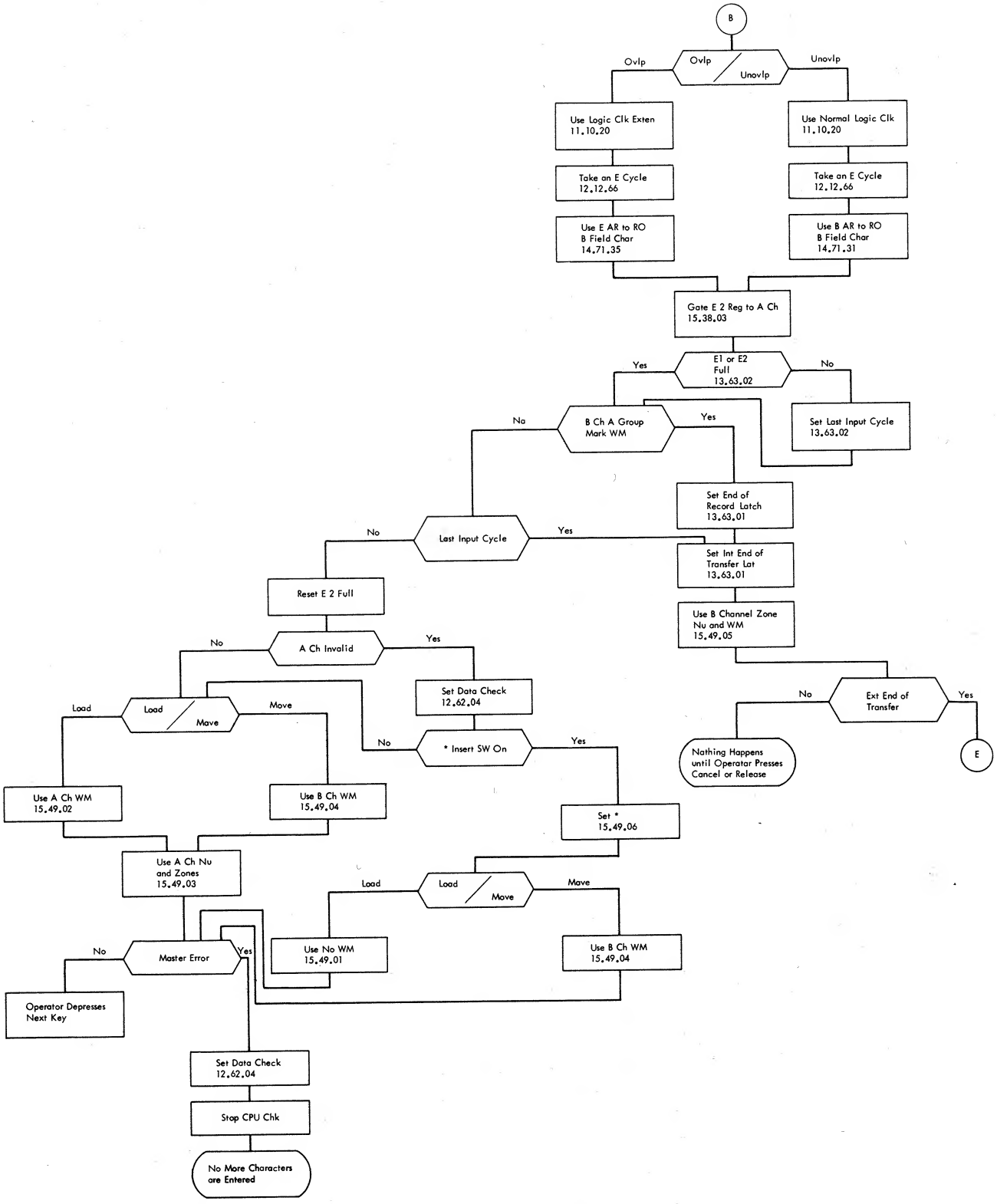


Figure 43. Inquiry Request and I-O Printer Read (Sheet 3 of 3)

If a character key is operated after the correct number of characters has been entered, the GM-WM is sensed. The end of record latch is turned on and the character, although it has printed, is not stored. The internal end of transfer latch is turned on but nothing will happen until the operator presses either the release or cancel key to turn on the external end of transfer latch. The wrong length record latch will then be turned on since E2 is full.

The inquiry cancel key operates in the same manner as the release key except that the condition latch is turned on. Correct or wrong length record will be set in the same way as was described for the release key. Operating either the release or the cancel key will turn off the inquiry request latch. If either key is pressed before the conditional branch instruction is reached, the result will be the same as if no inquiry request were made. If either key is operated after the branch instruction but before the console read instruction, the no-transfer latch will be turned on and the program will continue on to the next instruction. To turn the condition latch on, the cancel key must be pressed after the console read instruction since the cancel key signal AND's with the E channel select unit T line to bring up the E channel condition bus.

Write Console Printer—M/L (%TO) (B) W

The write console printer instruction causes a programmed print-out on the I-O printer. The console write instruction occurs in an unbuffered manner but, unlike the console read instruction, the operator does not need to take any action to initiate it. The console write instruction is used to answer inquiries or to print out any information that the programmer may wish to pass on to the operator.

To initiate a programmed print-out, the programmer inserts in his program the M/L (%TO) (B) W instruction. The B address gives the location of the first or high-order character of the message to be transferred to the console. The execution of the console write instruction begins with the print-out of the identification character R at matrix position 30. The matrix is advanced to MX31 and an output space operation is performed. After the space operation, the matrix advances to position 32 where it remains while the data are being printed out. The data from the B field transfer from storage and are printed on the I-O printer until a GM-WM is sensed in storage. If the operation is in move mode, the printer spaces when a valid blank (C bit) is sent from storage. If the operation is in load mode, the printer prints a "b" for a valid blank. Inverted circumflexes print for word marks in load mode only. A carrier return and index operation occur at the end of each printer line and at the end of the operation when the GM-WM is sensed.

OPERATION (Figure 44)

When the console write instruction reads out, the E channel reset line resets all the I-O status latches. If the matrix is not at home, the status sample A pulse sets the busy latch and last execute cycle is brought up. If the matrix is at home and all the status latches are off, the E channel in process latch is turned on. This latch and the E channel select unit T—output mode line bring up the console write op line. If the write instruction is in move mode, the console move write op line will also come up. Console home position and the console write op line up combine to bring up the console program print-out MX gate which turns on the matrix gate latch (45.20.06) to gate MX30 on. Matrix position 30 and the console write op line cause the identification character R to print in the first printing position. The matrix is then advanced to MX31 which gates an output space operation.

While the MX30 print operation takes place, the first E cycle is completed to fill E1. The character in E1 transfers to E2 and a second E cycle is taken to fill E1. By the time the matrix reaches MX32, both E1 and E2 are filled. The console write op line and console MX32 position line bring up the console E2 register gate line on 42.10.09, which gates the character in E2 to the console output lines. The character prints and at 90 degrees, when C1 N/O makes, the console printer strobe trigger is turned on. The console printer strobe brings up the console strobe line which combines with the E channel select unit T line to turn on the E channel strobe trigger. This trigger develops the E channel clocked strobe output line on 15.62.03 which causes a reset of the E2 full latch. With the E2 full latch off, the E2 register is filled from E1 and another E cycle is taken to refill E1. With E2 filled, another character can be printed. The matrix remains in position 32 and the characters continue printing out until the GM-WM is sensed.

When the last character transfers from E1 to E2, another E cycle is taken in which the GM-WM reads out of storage. The B channel GM-WM turns on the internal end of transfer latch on 13.63.01 and prevents the setting of E1. The E2 full latch on causes another print cycle to print out the last character and the console strobe again resets E2 full. E1 full off and E2 full off turn on the E channel disconnect latch which brings up external end of transfer. On 13.65.05, internal end of transfer and external end of transfer bring up status sample B which develops the last execute cycle I-O line. Status sample B delay causes the E channel in process line to go down which drops the console write op line.

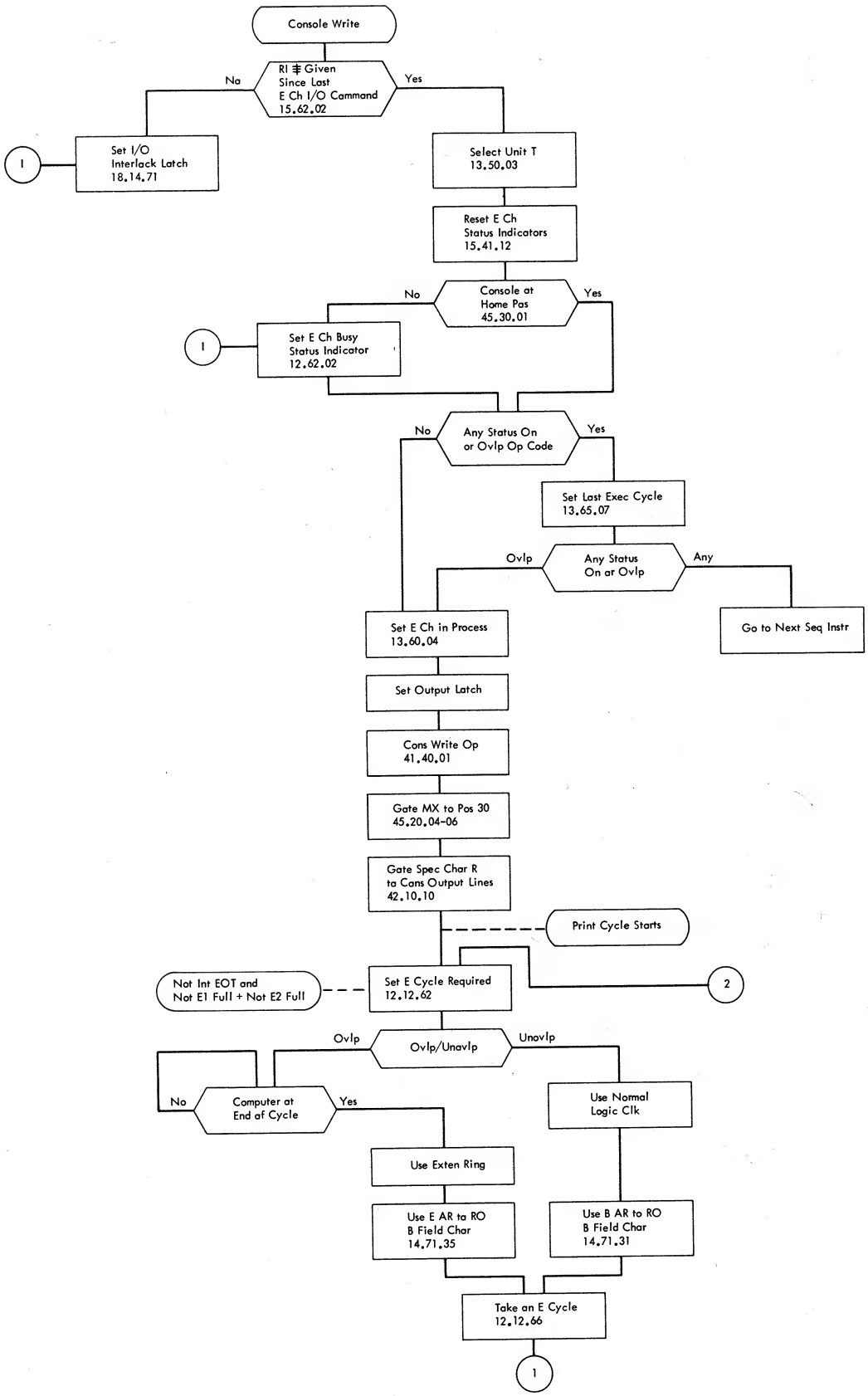


Figure 44. Console Write (Sheet 1 of 3)

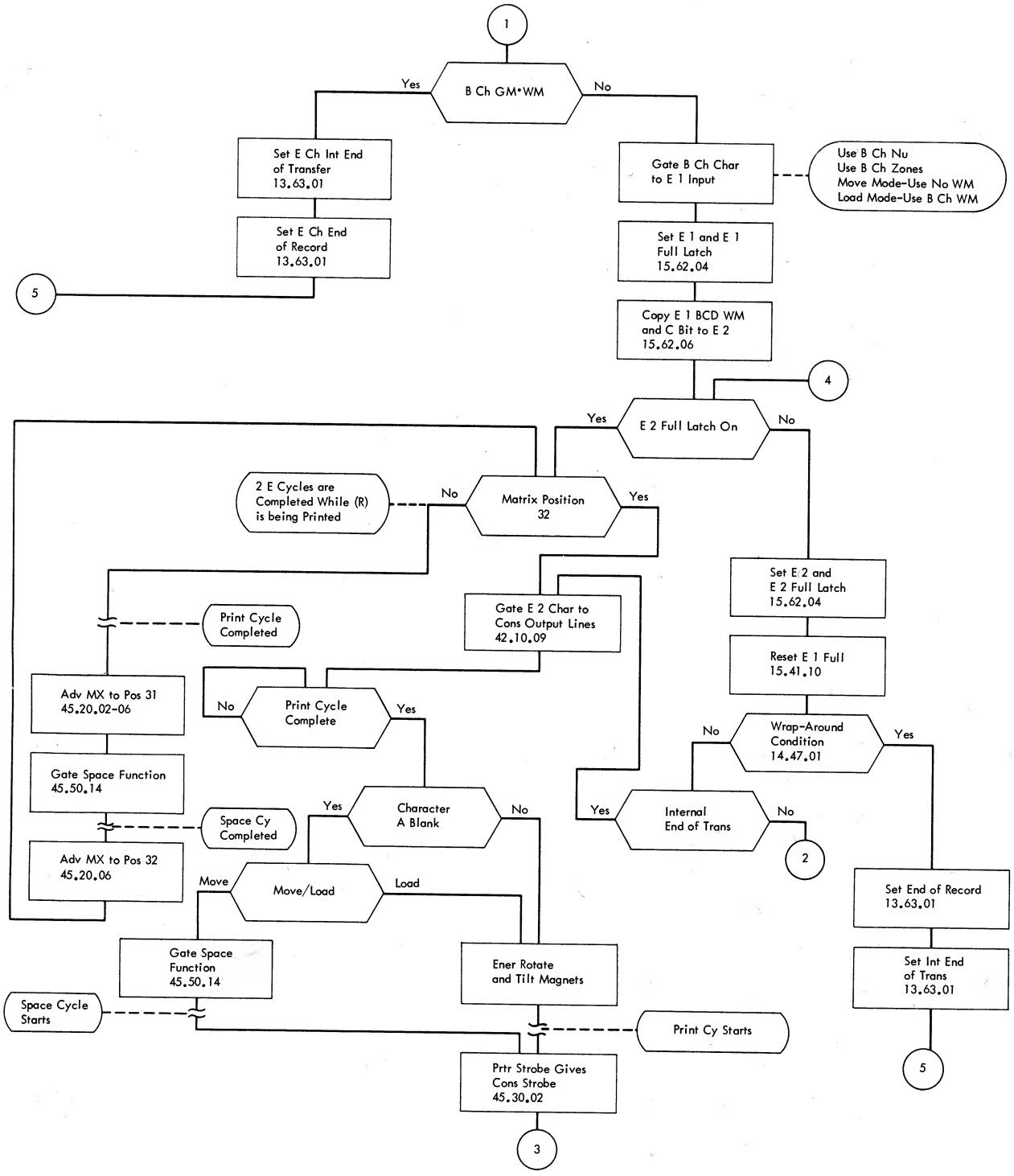


Figure 44. Console Write (Sheet 2 of 3)

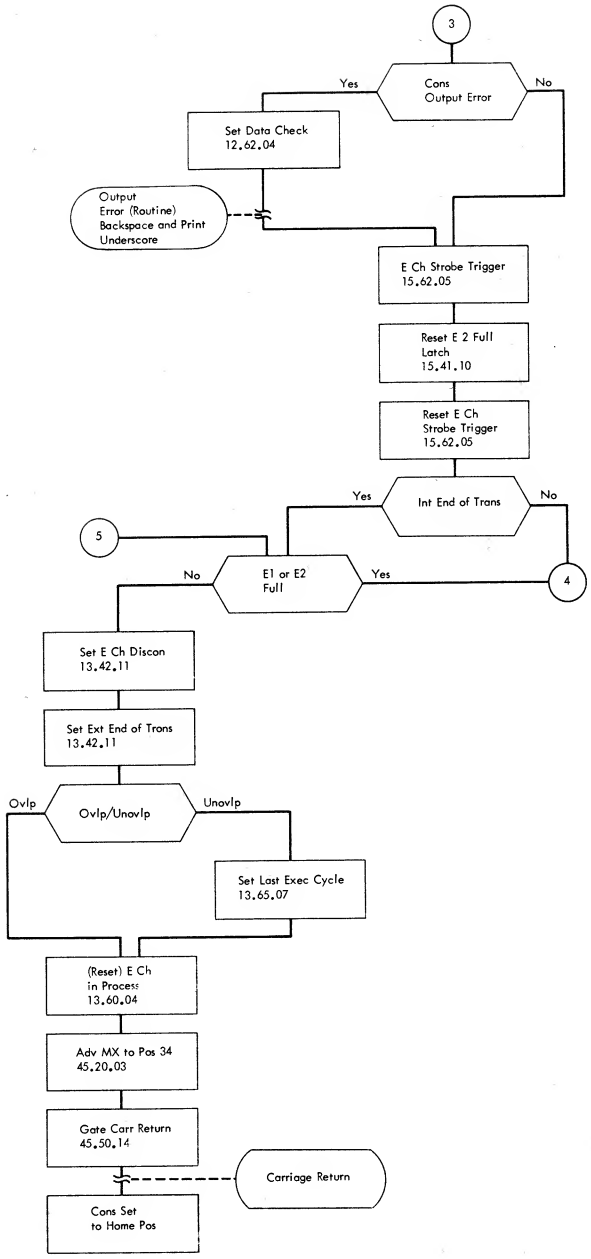


Figure 44. Console Write (Sheet 3 of 3)

On 45.20.03, the console write op line down allows the matrix to advance, and at MX34 a carrier return is initiated to end the operation. The matrix returns to home position.

Any errors occurring during a console write operation, except an I-O printer error, will cause the system to stop. If an error is detected by the printer, the data check-status latch will be turned on by the console data check line. The wrong length record, no transfer, condition, and not ready indicators are never turned on by console write operations. If a console write instruction is encountered while the carrier is returning, the E-channel busy indicator will be turned on.

1415 Console Review Questions

1. Define:

a. I-O printer output mode

b. I-O printer input mode.

2. During output mode, what select latch contacts are transferred when the character Q is printed?

3. During the printing of the _____ character on a line the _____ contact signals a carrier return.

4. List the functional operations that can be performed on the I-O printer.

5. Briefly explain the function of the console matrix.

6. What major components make up the console matrix?

7. What purposes do the select latch contacts serve?

8. List and describe the use of the five cycle control latches needed (one per cycle) to control all console printer operations.

9. Energizing the tilt and rotate magnets to trip the cycle clutch for a print cycle always requires two latches to be turned on for gating the circuits. Possible combinations are:

a._____and_____.

b._____and_____.

c._____and_____.

10. In display mode the first output print cycle causes the special character D to print. For what duration is the line "take console printer cycle" (45.30.01) active?

11. Print WM cycles on the I-O printer can be accomplished only in output mode. Why?

12. During output mode, a period with a word mark is to be printed.

a. Which rotate and tilt magnets are energized to print the period?

b. How is the cycle clutch tripped to cause the print cycle for the period?

c. *Which latch contacts will be transferred on this cycle?*

13. a. *Is the word mark considered in parity checking during output mode operations?*
    b. *Is parity checked during the print word-mark cycle?*

14. *List the sequence of operations when an error occurs during an output mode operation.*

15. *During output print cycles the console output error latch is* not *set if:*
    a. *A character with no* WM *bit is printed and the* _____ *bit check line is brought up.*
    b. *A character with a* WM *bit is printed and the* _____ *bit check line is brought up.*

16. *(Refer to question 12.) How is a parity error prevented when there is an odd number of contacts transferred on the period print cycle?*

17. *Console printer parity errors are underscored only during output mode operations. True or false?*

18. *A shift operation and a backspace operation can occur simultaneously. What control allows the backspace magnet to be energized while in a shift operation?*

19. *In output mode, what mechanical function does the console printer C3 or C4* N/O *line serve?*

20. *List the three types of stops that can initiate a stop print-out operation and the identification character that is printed for each type of stop.*

21. *List in sequence all the information that is printed in a stop print-out operation.*

22. *When performing an address set operation, how is a particular address register selected?*

23. *Logically, why must a display operation precede an alter operation?*

24. *During a display operation:*
    a. *What is the main control latch for the* MX-Y *drive advance when printing the special character D and initiating the space operation?*
    b. *What is the timing control for the* MX-Y *drive advance during the address set portion?*

25. *Which* CPU *error checking circuits are blocked during display and alter operations?*

26. CPU *storage cycles are required for manual type console operations such as display and alter. These storage cycles are controlled, started, and stopped by what latch?*

27. *When* must *a full line be displayed to perform an alter operation?*

28. *What is the purpose of the* CE *position of the mode switch?*

29. *During an inquiry operation, what location in storage does the keyed in data enter?*

30. a. *When would the cancel key be used during an inquiry operation?*
    b. *What E channel status latch does the cancel key set?*

31. *What two* CPU *instructions are normally used to start an inquiry routine after the inquiry request key has been pressed?*

32. a. *Can the wrong length record status latch be set during a read console printer operation?*
    b. *Can the wrong length record status latch be set during a write console printer operation?*

33. *What permits the storage cycles required for* I-O *percent-type operations?*

34. *List the status latches that can be turned on during a console write operation.*

35. *What happens when a read console printer instruction is encountered without an inquiry request having been made?*

36. *Write a short program loop using the* M %TO (B) R *and the* M %TO (B) W *instructions. Include correct handling of all status indicators that may be turned on.*

The 1415 CE console is located behind the hinged door of the control console (Figure 2). The CE console is provided primarily as a diagnostic aid for the customer engineer. Some switches on the CE console must be used for certain customer operations. Other switches and functions can be used to advantage by the customer. Refer to the *IBM 1410 Principles of Operation* publication, Form A22-0526, for a discussion of customer usage.

An off normal indicator light is provided on the 1415 indicator light panel to show when pertinent CE console switches are not in their normal positions (40.10.03). The switches and the settings that cause this light to come on are:

1. Address entry switch is not set to NORMAL.
2. Storage scan switch is not set to OFF.
3. Cycle control switch is not set to OFF.
4. Check control switch is not set to STOP NORMAL.
5. Disk write switch is set to INHIBIT.
6. Print out control switch is set to INHIBIT.
7. Asterisk insert switch is set to OFF.

As optional features are made available for the 1410 system, additional switches may be added to the CE console. These switches will be covered in the manuals pertaining to these features.

CE Controls

Address Entry Switch

The address entry switch (14.71.10) is used to select the desired address register when performing an address set operation. The normal setting selects the IAR. Operation of this switch is discussed under "Address Set."

Storage Scan Switch

The storage scan feature is primarily an aid in analyzing 1411 memory for read-in or regeneration failures. To make this feature operative, the console mode switch must be set to the CE position. If the read-in (load) function is desired, the bits to be entered are generated by setting the sense-bit switches. A starting address must be keyed in by the operator. Once started, the operation will continue until stopped by the operator or by an error stop.

Four different types of storage scan operations can be performed. The desired operation is selected with the storage scan switch (12.12.33, 14.71.41). The four settings of the switch are:

Regen +1 causes the character (at the location specified by IAR) to be read out of storage and regenerated back into the same location. The address is modified by plus-one and placed back in IAR. In this manner each position of storage is scanned, starting at the address keyed into IAR. When the highest address of storage is modified, the modification will wrap around to give the first address of storage (00000) and the operation continues. Wrap-around will not cause an error stop because address check is blocked during storage scan operations.

Regen 0 operates in the same manner as regen +1 except that the IAR is modified by zero. Because the IAR address does not change, the read-out and regeneration continue repeatedly in the same storage location.

Load +1 causes the character (addressed by IAR) to be read out of storage and be replaced by the bit structure set up in the sense-bit switches. The address is modified by plus-one and read back into the IAR. The IAR advances until the highest position of storage is loaded, then wraps around and continues from location 00000. This operation results with the same character being written into every storage location. On load operations B channel and address check (wrap-around) errors are blocked.

Load 0 operates in the same manner as load +1 except that the IAR is modified by zero. The address that was keyed into the IAR remains the same. The bits selected by the sense-bit switches are continually read into the same location of storage.

OPERATION

The storage scan operation (Figure 45) is initiated by setting the mode switch to the CE position. This position of the mode switch activates the storage scan switch which is set to the type of operation desired. If a load mode is selected, the sense-bit switches are set for the bit structure to be entered.

After all the switches have been set, the operation is started by pressing the start key. Storage scan mode, stopped at last execute cycle up, and console home position allow the start key line to turn on the console cycle start latch (Figure 39). The console cycle start latch on performs the following:

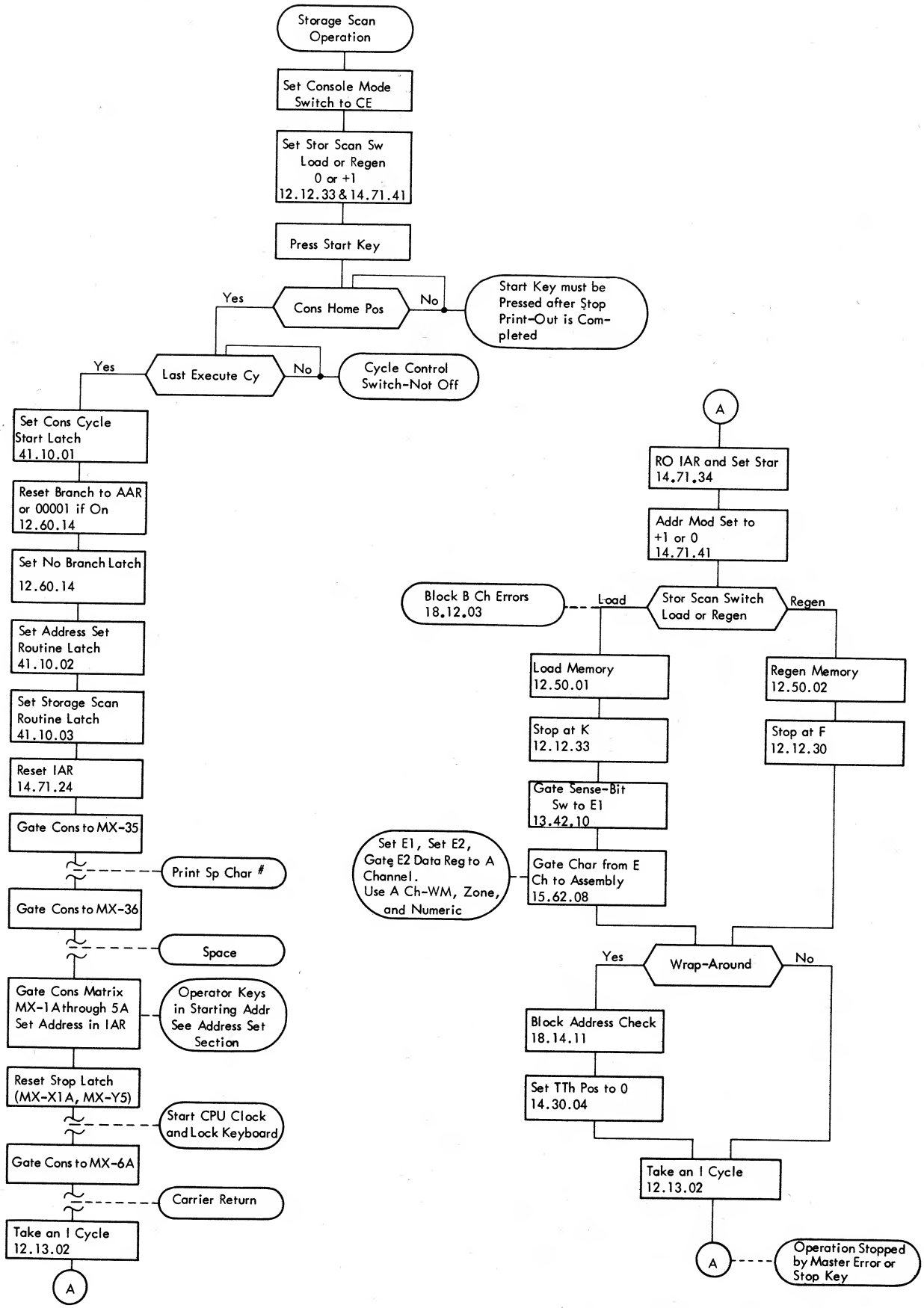


Figure 45. Storage Scan Operation

1. AND's with storage scan mode (Figure 37) to bring up the program set branch control line which resets the branch to AAR latch, if on, and sets the no branch latch.

2. Sets the MX-Y5 trigger which gates on MX position 35.

3. AND's with a CC1 pulse to bring up the console routine start line which turns on the address set routine and storage scan routine latches.

4. Generates the console reset start condition line (41.10.01) which resets the I-cycle control latch and I-ring control latch.

5. AND's with set IAR line (14.71.24) to develop the reset IAR line.

The MX35 line AND's with address set routine and the console CE pound print line (42.10.10) to bring up the special character pound line. The pound sign (#) is printed in the first printing position to identify the operation. During this print cycle, the console printer strobe line AND's with storage scan routine to turn on the I-cycle control latch. After the pound sign prints, the matrix advances to position 36 where a space cycle occurs. The matrix is gated to position 1-A following the space cycle. MX1-A position brings up the address set unlock line which unlocks the keyboard, allowing the operator to enter the starting address. This address set portion of the operation is performed in the same manner as described under "Address Set." The starting address is keyed into the IAR using matrix positions 1-A, 2-A, 3-A, 4-A, and 5-A.

When the fifth address set position has been keyed in, the address set routine latch is reset and the address set keyboard lock line developed. This line AND's with storage scan routine to reset the stop latch (12.15.04), allowing the CPU clock to start. The CPU then takes I-cycles. The I-cycles are regenerated by the I-cycle control latch which is turned on each cycle by I-cycle latch on and storage scan routine. Logic gate special A allows the RO IAR line to be brought up when the storage scan routine latch is on (14.71.34).

Subsequent operations for the four different modes are:

Regen + 1: Storage scan routine and the storage scan regen mode line bring up the storage scan regen line on 12.12.30. The storage scan regen line develops the regen memory line on 12.50.02 which causes the regeneration of the characters read out. On 14.71.41, storage scan routine, I-cycle control, and the storage scan switch set to plus-one bring up the address modification set to plus one line which causes proper address modification.

Regen 0: Operates in the same manner as regen + 1 except for address modification. On 14.71.41, storage scan routine, I-cycle control, and the storage scan switch set to zero bring up the address modification set to zero line which causes the IAR address to remain the same.

Load + 1: Storage scan routine and the load position of the storage scan switch bring up the storage scan load line on 12.12.33. This line develops the load memory line (12.50.01). The sense-bit switches are gated to the assembly channel and to storage. On 15.62.08 the storage scan load line develops the gate console to assembly line. The gate bit-sense switch line is brought up on 13.42.10. As in regen + 1, the address modification set to plus one line is brought up on 14.71.41 to cause proper address modification.

Load 0: Performed in the same manner as load + 1 except for address modification. Storage scan routine, I-cycle control, and the storage scan switch set to a zero position bring up the address modification set to zero line which causes the bits to be continually loaded into the same memory location.

If an error occurs during the storage scan operation, the operation stops and a stop print-out occurs (print-out control switch normal). The IAR address that prints out is the location where the error occurred for modification by zero operations. If the operation was regen + 1 or load + 1, the IAR address is one higher than the error location. When the stop print-out is completed, pressing the start key will continue the operation. The storage scan operation can be terminated at any time by pressing the stop key or by moving the mode switch from the CE position.

Cycle Control Switch

The cycle control switch (44.10.01) is operative only when the mode switch is set to the run, I/E cycle, or CE positions. The cycle control switch setting determines how far the clock circuits advance each time the start key is pressed. If the switch is set to OFF, the normal CPU circuits control the logic clock.

Logic Step: When the logic step position is selected, pressing the start key advances the logic clock by single logic gate pulses. The start key resets the stop latch. The stop latch is set on the next second clock pulse (12.15.04). The clock advances only one logic gate pulse.

Storage Cycle: This switch setting causes one complete cycle (I, A, B, C, D, E, F, or X) to be taken each time the start key is pressed. The start key resets the stop latch. The stop latch is again set on the second clock pulse of logic gate Z, or at the end of the storage cycle (12.15.04).

When the clock stops, a stop print-out occurs unless it is inhibited. The console cycle stop line (44.10.02) causes the special character C to print in the first printing position. If the mode switch is set to run or I/E cycle and an I-O operation is encountered, the clock runs until the end of the operation.

Check Control Switch

The check control switch (13.42.10) is a three-position rotary switch. When a master error causes the system to stop, the setting of this switch controls the subsequent action. Three settings are provided: stop normal, restart, and reset and restart.

Stop Normal: A stop print-out will occur when the system stops if the print-out control switch is set to normal. The system remains stopped.

Restart: After the stop print-out is completed, the program automatically restarts (Figure 46). If the print-out control switch is set to inhibit, the program restarts immediately.

Reset and Restart: After the stop print-out is completed, a computer reset operation is initiated (Figure 46). When the reset operation is completed, the program restarts. If the stop print-out is inhibited, computer reset comes up immediately and is followed by the restart.

Start Print-Out Switch

The start print-out push-button switch (44.10.01) allows the operator to initiate a stop print-out routine. The print-out control switch must be set to normal before the start print-out switch is pressed.

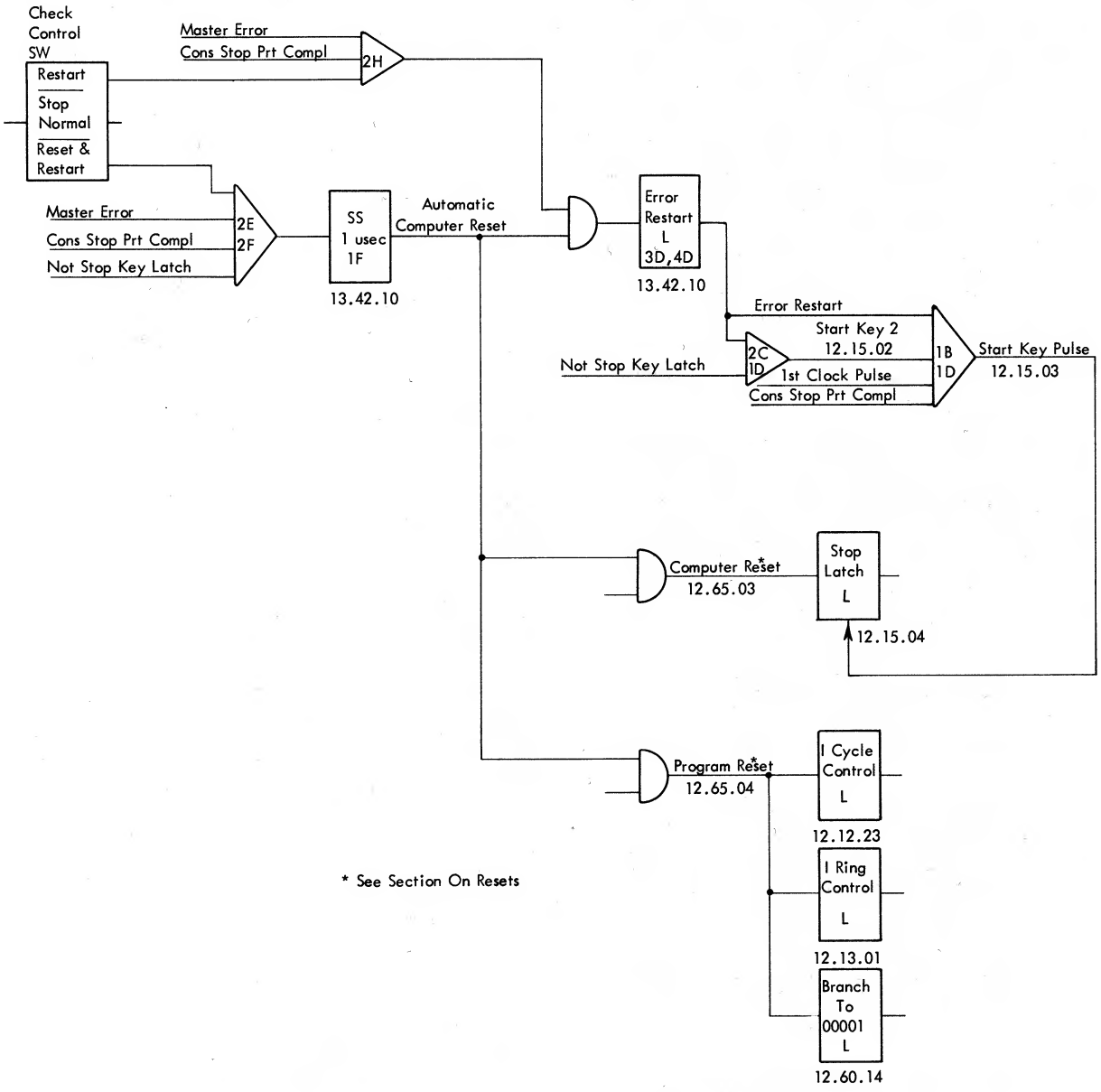


Figure 46. Reset and Restart

Print-Out Control Switch

The print-out control switch (44.10.01) is set to normal when it is desired to have a log of system stops. If stop print-outs are not desired, the switch is set to the inhibit position (see "Stop Print-Out").

Asterisk Insert Switch

When the asterisk insert switch (15.49.06) is on and an input device character of incorrect parity is detected on the A channel, an asterisk is entered into the addressed position of storage. The set asterisk line is developed on 15.49.06. The normal A channel validity check stop is disabled by the asterisk A channel check control line on 18.11.03. An inserted asterisk will turn on the data check status latch.

When the asterisk insert switch is off, an incorrect parity character from an input device causes an A channel validity error. The master error line is brought up which stops the CPU.

Normal programming requires that the asterisk insert switch be left in the on position. This is done so that the program many continue and make use of the branch on I-O status indicator commands. Subsequent routines may then be initiated (for example re-read tape or write out a message on the console printer.

Check Test Switches

The three check test switches (18.14.10) are provided for testing the checking circuits in the CPU. Three switches (therefore three tests) are necessary to test all the transistors used in the checking circuits.

For each of the three tests, a program reset is iniated. The check test switch is pressed and held down while the start key is pressed. The stop latch is reset, the clock is started, and the CPU takes an I-cycle. A master error will result and the CPU should stop with every process system check light on. If any check light fails to come on during any one of the three tests, a failure in the associated checking circuitry is indicated.

Errors are forced in the various check circuits in the following manner.

B-Register Set Check:

1st check test—flips 1st trigger-check trigger (18.14.06)

2nd check test—flips reset memory-data-register trigger (18.14.06)

3rd check test—flips reset memory-data-register trigger (18.14.06)

Op Register Set Check:

1st check test—flips check op-register trigger (18.14.04)

2nd check test—flips set op-register trigger (18.14.04)

3rd check test—flips set op-register trigger (18.14.04)

Op Modifier Set Check:

1st check test—flips check op-modifier trigger (18.14.05)

2nd check test—flips set op-modifier-register trigger (18.14.05)

3rd check test—flips set op-modifier-register trigger (18.14.05)

A-Character Select Error:

1st check test—blocks all gating to A-channel (18.14.01)

2nd check test—forces gate F2 data register to A-channel (18.14.01)
—forces gate E2 data register to A-channel (18.14.01)

3rd check test—forces gate op modifier register to A-channel (18.14.01)
—forces gate A-data register to A-channel (18.14.01)

B-Character Select Error:

1st and 2nd check test—forces character select error check 1 and 2 (35.10.03)
—blocks load and regen memory (12.50.01-02)

3rd check test—blocks load and regen memory (12.50.01-02)

A-Channel Validity Check:

1st check test—forces 1 · 8 even and 1 · 8 odd (18.11.01)

2nd check test—forces numeric-odd and numeric-even (18.11.01)

3rd check test—forces numeric C-bit and not numeric C-bit (18.11.02)

B-Channel Validity Check:

1st check test—forces 1 · 8 even and 1 · 8 odd (18.12.01)

2nd check test—forces numeric-odd and numeric-even (18.12.01)

3rd check test—forces not numeric C bit and numeric C bit (18.12.02)

Assembly Channel Validity Check:

1st check test—forces 1 · 8 odd and 1 · 8 even (18.13.01)

2nd check test—forces numeric-odd and numeric-even (18.13.01)

3rd check test—forces zones-odd and zones-even (18.13.02)

Address Channel Validity check:

1st check test—forces vc group one and vc group two (14.47.01)

2nd check test—resets address mod and mod control latches (14.71.40)

3rd check test—sets address channel error latch (18.14.03)

Address Exit Validity Check:

1st check test—forces AR-channel VC groups one and two (14.16.03)

2nd check test—forces console address register exit gate (42.10.09)

3rd check test—gates on address exit error trigger (18.14.02)

A-Register Set Check:

1st check test—flips set A-data-register trigger (18.14.07)

2nd check test—flips reset A-data-register trigger (18.14.07)

3rd check test—flips reset A-data-register trigger (18.14.07)

Sense Bit Switches

The sense bit switches (15.60.01-08) are used as bit entry switches when storage scan load operations are performed. The storage scan load line brings up the gate bit sense switch line (13.42.10) which gates the selected bits on the E1 input line.

Disk Write Switch

The disk write switch facilitates testing programs on a 1410 system containing the disk storage optional feature. This switch, in the inhibit position prevents writing on disk storage. All disk storage instructions except write disk and write disk with word marks are performed normally.

Tape Density Switches

The tape density switches are an optional feature for selecting the recording density combinations desired for any 729 V or 729 VI tape units on the designated channel. For example: If the channel 1 console density switch is set to the HI position, the HI-LO switch of the individual tape units on channel 1 will select either 800 or 556 cpi. If the console density switch is set to the LO position, the HI-LO switch of the individual tape units will select either 556 or 200 cpi. The center position of the switch selects either 800 or 200 cpi.

1401 Compatibility Controls

Compatibility Switch

The compatibility switch (12.65.10) is set to the 1401 setting when it is desired to run 1401 programs on the 1410 system. Refer to the *IBM 1410-1401 Compatibility CEMI*, Form 223-2597, and the *IBM 1410 Principles of Operation* publication, Form A22-0526, for information on compatibility. When the compatibility switch is set to 1401, the I-O check stop switch (12.15.04) and the I-O check reset switch (13.65.01) become operative. When the system is operating in the 1401 mode, manual console operations (display, address set, storage scan) still require a five-digit address.

Sense-Bit Switches

The sense-bit switches (15.60.01) are active as sense switches (A through G) when operating in the 1401 mode. As sense switches they are tested by the program with a branch-if-indicator-on instruction. On 13.42.10 the 1401 condition test op code line brings up the gate bit sense switch line.

Start Reset

The start-reset pulse resets the master controls to allow the operator to proceed through a program, if a master error stops the operation. Start reset is initiated by the start-key pulse. The start-key pulse is only available when the start key is pressed when in the run mode, I/E mode, or storage scan mode (after the address set routine).

The various latches and triggers that are reset by the start reset are:

Control	Status	ALD
Address check latch	Off	18.14.11
Error sample trigger	Off	18.14.08
Address ch error trigger	Off	18.14.03
Address exit error trigger	Off	18.14.02

Program Reset

Pressing the program reset key causes the following operations to take place.

1. The cycle control, scan control, and scan latches are reset.
2. The I- and A-ring triggers are reset.
3. The op register, op modifier register, and the A-data register are reset to contain C-bits.
4. The branch to 00001 latch is set.
5. The storage address register is reset.
6. The set check circuits are reset.
7. The 1401 control latches are reset.
8. The arithmetic control latches are reset.
9. The logic clocks are reset.
10. Program reset causes a start reset.
11. The console control latches are reset.

The program reset is developed as follows:

Signal	Control	ALD
Program Reset	Prog Reset Key (Logic clock) stopped at A	12.65.04

Following is a listing of the various latches and triggers that are reset by the program reset.

Program Reset 1 (12.65.04)

Control	Status	ALD
X-cycle latch	Off	12.12.05
A-cycle ctrl latch	Off	12.12.20
C-cycle ctrl latch	Off	12.12.20
B-cycle ctrl latch	Off	12.12.21
D-cycle ctrl latch	Off	12.12.21
I-cycle ctrl latch	On	12.12.23
X-cycle ctrl latch	Off	12.12.23
No-scan latch	Off	12.30.01
1st-scan latch	Off	12.30.01
2nd-scan latch	Off	12.30.02
Spl adv ctrl latch	Off	12.13.01
I-ring ctrl latch	On	12.13.01
No-scan ctrl latch	Off	12.30.03
1st-scan ctrl latch	Off	12.30.03
2nd-scan ctrl latch	Off	12.30.04
3rd-scan ctrl latch	Off	12.30.04
I-ring triggers	Off	11.20.01-07
A-ring triggers	Off	14.70.01-06
Console WM input latch	Off	15.60.09
*Op reg C-bit latch	On	13.10.01
*Op reg A, B, 8, 4, 2, and 1 bit latches	Off	13.10.01
Binary reg bit latches	Off	14.18.01-02
Memory addr reg latches	Off	14.17.01-15
Index tag latches	Off	14.50.01-02
A-data reg latches (A, B, 8, 4, 2, 1 bits and WM)	Off	15.39.01-08
A-data reg C-bit latch	On	15.39.07
Op mod C-bit latch	On	13.12.01
Op mod A, B, 8, 4, 2, and 1 bit latches	Off	13.12.01-03

*The op register is reset by gating the set op register pulse. No character is gated to the B-channel because neither memory load nor regen is conditioned. Because no bits are on the B-channel, the set op register pulse resets all of the op register latches except the C-bit latch that is set ON by inverting the not B channel C-bit line.

Program Reset 2 (12.65.06)

Control	Status	ALD
I-O percent latch	Off	13.50.01
I-O coml at latch	Off	13.50.01
I-O lozenge latch	Off	13.50.02
1401 read error latch	Off	13.65.01
1401 file validity-check latch	Off	13.65.02
1401 wrong-length record latch	Off	13.65.02
1401 file address compare latch	Off	13.65.02
1401 process check latch	Off	13.65.03
1401 inquiry error latch	Off	13.65.08
1401 punch trigger	Off	13.70.02
1401 I-O end	Off	13.70.02
1401 print trigger	Off	13.70.01
1401 read trigger	Off	13.70.01
1st I-O cycle control trigger	Off	13.70.03
E-cycle latch	Off	12.12.66
F-cycle latch	Off	12.12.67

Program Reset 3 (12.65.05)

Control	Status	ALD
Logic gate triggers (A-U)	Off	11.10.11-23
Console set start cond latch	Off	12.15.03
Process routine latch	Off	12.15.03
No-branch latch	Off	12.60.14
Branch to A-AR latch	Off	12.60.14
Branch to 00001 addr latch	On	12.60.14
Set op reg trigger	Off	18.14.04
Check op reg trigger	Off	18.14.04
Reset mem data reg trigger	Off	18.14.06
1st trigger check	Off	18.14.06
Set A-data reg trigger	Off	18.14.07
Reset A-data reg trigger	Off	18.14.07

PROGRAM RESET 4 (12.65.05)

CONTROL	STATUS	ALD
Console reset-start condition latch	Off	41.10.01
Address set-routine latch	Off	41.10.02
Display routine latch	Off	41.10.03
Storage scan latch	Off	41.10.03
WM cond alter latch	Off	41.20.01
Full-line cond alter latch	Off	41.20.01
Console stop condition latch	Off	44.10.01
Console stop print latch	Off	44.10.02
Console clock trigger	Off	45.10.01
Console cycle matrix triggers	Off	45.20.02-06
Console cycle latch	Off	45.50.01
Typewriter start ctrl latch	On	45.50.01
Console check strobe trigger	Off	45.50.01
Console printer strobe trigger	Off	45.50.02
Typewriter start latch	Off	45.50.03
Solenoid driver strobe latch	Off	45.50.03
Printer strobe reset latch	Off	45.50.02
Console char control latch	Off	45.50.10
Console output error latch	Off	45.50.11
WM period latch	Off	45.50.11
Console error control	Off	45.50.12
Console backspace control	Off	45.50.13
Console function control	Off	45.50.14
Console printer last column	Off	45.50.15
Matrix gate latch	Off	45.20.06

PROGRAM RESET 5 (12.65.06)

CONTROL	STATUS	ALD
True latch	Off	16.20.14
Complement latch	Off	16.20.15
Carry latch	Off	16.20.21
No-carry latch	Off	16.20.22
Units ctrl latch	Off	16.30.02
Body ctrl latch	Off	16.30.04
Extension ctrl latch	Off	16.30.06
Mplr quot ctrl latch	Off	16.30.07
MDL latch	Off	16.62.01
Even-hundreds address latch	Off	14.71.40
Reset address mod latch	Off	14.71.40
Logic gate special A	On	11.30.02
Logic gate triggers (V-X)	Off	11.10.24-26

Computer Reset

The computer reset key initiates the following operations:

1. Program reset and start reset
2. Resets all check circuits
3. Resets all timing clocks
4. Resets all machine indicators, overflow latches, and compare triggers
5. Inquiry latches are *not* reset
6. The tape density latches are never reset.

If the logic clock is not stopped at A when computer reset is pressed, the clock is allowed to advance to logic gate A. After enough time to reset the clock has elapsed, the computer and program resets are initiated.

SIGNAL	CONTROL	ALD
Pwr on + cpr reset	Co cpr rst (Key) or CE cpr rst (Key)	12.65.01
Early computer reset (SS)	Pwr on + cpr resets	12.65.01
Cpr rst clock start (SS)	Early computer reset	12.65.01
Stop latch (off)	Cpr rst clock start	12.15.04

The clock is stopped at A or R.

SIGNAL	CONTROL	ALD
Stop latch (on)	Early computer reset Logic gate A or R	12.15.04

After the computer reset clock start single-shot has timed out, computer and program resets are initiated.

SIGNAL	CONTROL	ALD
Computer reset	Pwr on + cpr resets Comp rst clock st (timed out)	12.65.03
All power on · Cpr resets	Pwr on + cpr resets Comp rst clock st (timed out)	12.65.03
Program reset	All power on · cpr resets	12.65.04

The control, status, and logic location of computer reset are:

COMPUTER RESET 1 (12.65.03)

CONTROL	STATUS	ALD
Stop latch	On	12.15.04
F1 reg word sep latch	Off	13.64.02
F2 reg word sep latch	Off	13.64.02
Select and RBC on latch	Off	13.72.03
F-ch RBC latch	Off	13.73.03
E-ch out mode latch	Off	15.62.01
E-ch in mode latch	Off	15.62.01
E-ch move mode latch	Off	15.62.02
E-ch load mode latch	Off	15.62.02
F-ch move latch	Off	15.63.02
F-ch interlock	Off	15.63.02
Not zero bal latch	On	16.14.11
Zero bal latch	Off	16.14.12
No overflow latch	On	16.45.02
Overflow latch	Off	16.45.02
Not div overflow latch	On	16.45.01
Div overflow latch	Off	16.45.01
High latch	Off	17.14.01
Low latch	On	17.14.02
Equal latch	Off	17.14.03

COMPUTER RESET 2 (12.65.03)

CONTROL	STATUS	ALD
B-data reg reset trigger	Off	39.10.01
Y-rd trigger	Off	39.10.01
X-rd trigger	Off	39.10.01
Z-pulse trigger	Off	39.10.02
Y-wr trigger	Off	39.10.02
X-wr trigger	Off	39.10.02
X-pwr gt ctrl trigger	Off	39.10.03
Y-pwr gt ctrl trigger	Off	39.10.03
Y-sense strobe trigger	Off	39.10.03
Computer reset to tape E-ch	On	12.65.03
TAU reset	On	60.58.31
In process reset	On	12.65.03
E-ch comp reset to file	On	12.65.03
Computer reset to tape F-chan	On	12.65.03
F-ch comp reset to file	On	12.65.03
Computer reset to buffer	On	12.65.03

Power-On Reset

The power-on reset is developed through the normally closed points of relay 7.

This causes a power-on reset whenever power sequence is up or down. Program reset, start reset, and computer reset are initiated. The clock is reset to A in the same manner as under *Computer Reset.* In addition, a system reset is initiated to reset the address registers and the inquiry-request control latch. The system reset is developed as follows:

Signal	Control	ALD
System reset	Pwr on + cpr resets Pwr on reset Comp rst clock start (Timed out)	12.65.02

The following latches are reset with the system reset:

Control	Status	ALD
Reset CAR (all latches off)	On	14.71.22
Reset BAR (all latches off)	On	14.71.21
Reset AAR (all latches off)	On	14.71.20
Reset DAR (all latches off)	On	14.71.23
Reset IAR (all latches off)	On	14.71.24
Reset EAR (all latches off)	On	14.71.25
Reset FAR (all latches off)	On	14.71.26

1415 I-O Printer

Adjustments, removals, and scheduled maintenance for the I-O printer can be found in the *IBM Selectric Universal I-O Keyboard Printer Reference Manual,* 225-1726. Some of the key levers normally used for functional operations are modified to provide special functions on the 1415 I-O printer.

Specifications and Timings

The following specifications apply to the I-O printer used in the 1415 console.

On-Off Key: The power on-off key is not used and is locked out.

Clear-Set Key: The tab clear-set key is not used and is locked out.

Margin Release Key: The margin release key is not used and is locked out.

Word-Mark Key (Tab Key): The tab feature is not used on the 1415 I-O printer. Word-mark input utilizes a portion of the power tab mechanism to operate the word-mark transmitting contacts.

Inquiry Request Key (Carrier Return Key): A carrier return cannot be initiated from the keyboard. The normal function of the key lever is crippled by removing the key lever pawl lug. A set of N/O contacts is placed under the key lever to perform the inquiry request function.

Inquiry Release Key (Backspace Key): A backspace operation cannot be initiated from the keyboard. This function is crippled by removing the key lever pawl lug. A set of N/O contacts is used to perform the inquiry release function.

Inquiry Cancel Key (Index Key): An index (line space) operation can only occur with a carrier return operation. Manual indexing is prevented by removing the key lever pawl lug. A set of N/O contacts is placed under the key stem to perform the inquiry cancel function.

Non-Repeat Key Levers: The word mark and space keys are non-repeating in the 1415 I-O printer. When properly adjusted, the key levers are operated once for each machine cycle. The space bar final stop is adjusted to the top limit to insure single-space only operation.

Operational Interposers: Only the word mark and space key lever pawls can operate an interposer. The lugs are removed from the other key levers.

Operational Magnets: The word mark (tab) and index magnets are not used.

Degree Wheel: A calibrated degree wheel is mounted on the left end of the cycle shaft to provide accurate setting of contact timings. With the cycle shaft latched up (under power), the pointer should line up with 0 or 180 degrees.

Form Size: The pin feed platen on the 1415 I-O printer requires paper having horizontal pin hole spacing of 9⅜ inches and vertical spacing of ½ inch. The form width is 9⅞ inches.

C1-C2 Timings: The correct timings for the N/O contacts of cams C1 and C2 are shown in the following list. Two sets of timings are given because the cams rotate 180 for each print cycle.

CAM	MAKE	BREAK	CAM DWELL
C1	90° ± 3°	135° ± 3°	45°
C1	270° ± 3°	315° ± 3°	45°
C2	35° ± 3°	125° ± 3°	90°
C2	215° ± 3°	305° ± 3°	90°

Some older machines may have a C1 cam with a 55 degree dwell. With this cam C1 should make at 80 and 260 degrees. The break timings remain the same.

Functional Contact Timings: The timings for the shift, space, and carrier return interlock contacts are shown on the timing charts in this section.

End-of-Line Contact Timing: With the carrier in the next-to-last column, position the line lock bracket ramp sideways so that the finger of the bell ringer bellcrank is just starting to climb the inclined surface and cause the bell ringer bail to be deflected forward. Check that the finger just reaches the top of the inclined surface with the carrier in the last column position. The timing should be refined under dynamic conditions such as a long display print-out. An even right margin will result with correct adjustment. On an input operation (alter), it should be possible to enter a character with a word mark over it in the last column position.

Line Lock: Form the line lock actuating arm on the bell ringer bail so that the line lock interposer is fully depressed when the carrier pointer is in line with the mark on the right-hand margin stop. The line lock must operate reliably but cannot be allowed to lock the keyboard on an input mode operation until after the end-of-line contacts close. If it locks too soon, the machine will lock the keyboard with no signal being sent to the 1411 that the end-of-line has been reached.

Printer Charts and Diagrams

The following charts and diagrams are included in this section:

Printer Magnet-Contact Chart (Figure 47)
Key and Contact Summary (Figure 48)
Printer Timing Charts (Figures 49, 50, 51, 52 and 53)
1415 Printer Wiring Diagram (Figure 54)

1415 Console

The following material contains reference information applicable to console operations. A location list of console switches and a second level diagram of start, stop key pulse generation (Figure 55) are included. Figure 56 is a flow chart of matrix positions for console operations.

−V LEVELS FROM CONSOLE CIRCUITRY

The V voltage level symbol is used for circuits with mechanical contacts connected to −36 volts. The nominal voltage swing is from 0 to −36 volts. However, when a V level is terminated through a resistor-capacitor network, the voltage swing will depend on individual circuit loading.

If the V level is terminated through a 2.4K resistor (9043 card) and .047 μf capacitor (AET card), the voltage swings are as follows:

1. When used as an input to a standard NOR logic black, the swing is between 0 volt and −20 to −28 volts.

2. When used as an input to a line terminator (DFZ, DGA, etc.), the swing is between +1 volt and −1 volt.

I/O PRINTER INPUTS DURING UPPER CASE OPERATIONS

1. An incorrect character can be entered into the 1410 system without the character appearing on the console log. If the I-O printer is held in upper case position and the spacebar operated, a valid 9 is entered into memory in place of a space character. This would normally occur when a special program requires the entry of several successive upper case characters with one or more spaces between them.

2. For diagnostic purposes it may be desired to enter invalid parity characters into the system from the console. A ■ will be printed on the console log except for upper case period which prints as a WM (V), and upper case pound (#) which prints as an underscore. These conditions are as follows:

Upper Case of Key	Enters as	Parity
A	H	Correct
B	.	Correct
C	?	Correct
J	Q	Correct
K	$	Correct
L	!	Correct
S	,	Correct
T	≠	Correct
1	8	Correct
2	#	Correct
3	ϕ	Correct
$	J	Correct
,	/	Correct
.	A	Correct
/	Y	Correct
#	1	Correct
H	&	Incorrect
I	A	Incorrect
Q	—	Incorrect
R	J	Incorrect
Y	¢	Incorrect
Z	/	Incorrect
8	b	Incorrect
9	1	Incorrect

CONSOLE SWITCH LOCATIONS

Console Switch	ALD
Power On	98.15.10
Power Off	98.15.10
DC Off	98.15.10
Emergency Off	98.15.10
Mode	40.10.01
Start	12.15.02
Stop	12.15.03
Computer Reset	12.65.01
Program Reset	12.65.01
Address Entry	14.71.10
	40.10.03
Storage Scan	12.12.33
	14.71.41
	40.10.03
Cycle Control	40.10.03
	44.10.01
Check Control	13.42.10
	40.10.03
Disk Write	40.10.03
Start Print-Out	44.10.01
1410/1401 Compatibility	12.65.10
1401 I-O Check Reset	13.65.01
I-O Check Stop	12.15.04
Check Test	18.14.10
Asterisk Insert	15.49.06
	40.10.03
Inhibit Print-Out Control	40.10.03
	44.10.01
Sense-Bit	15.60.01-08
I-O Unit Select	19.10.01
Priority	19.10.01
Real Time Clock	14.15.20

Character	BCD Code	Case	Rotate	Tilt	Magnets Energized			Contacts Transferred		
					Rotate	Tilt	Ck	Rotate	Tilt	Ck
b output	C	U	0	0	1 2 2A	1 2				C
b input	C	U	0	0				1 2 2A 5		C
•	BA8 21	L	+5	3			C	1 2 2A	1 2	
¤	CBA84	U	−3	3	1 2A 5			2 5	1 2	C
[	BA84 1	U	+2	3	1 2A		C	2	1 2	
<	BA842	U	−2	3	2A 5		C	1 2 5	1 2	
≠	CBA8421	U	+3	3	2A			1 2	1 2	C
& output	CBA	U	0	3	1 2 2A				1 2	C
& input	CBA	U	0	3				1 2 2A 5	1 2	C
$	CB 8 21	L	+5	2		1		1 2 2A	2	C
*	B 84	U	−3	2	1 2A 5	1	C	2 5	2	
]	CB 84 1	U	+2	2	1 2A	1		2	2	C
;	CB 842	U	−2	2	2A 5	1		1 2 5	2	C
△	B 8421	U	+3	2	2A	1	C	1 2	2	
- output	B	U	0	2	1 2 2A	1	C		2	
- input	B	U	0	2				1 2 2A 5	2	
/	C A 1	L	−5	1	1 2 2A 5	2		5	1	C
,	C A8 21	L	+5	1		2		1 2 2A	1	C
%	A84	U	−3	1	1 2A 5	2	C	2 5	1	
~	C A84 1	U	+2	1	1 2A	2		2	1	C
\	C A842	U	−2	1	2A 5	2		1 2 5	1	C
++	A8421	U	+3	1	2A	2	C	1 2	1	
↑ output	A	U	0	1	1 2 2A	2	C		1	
↑ input	A	U	0	1				1 2 2A 5	1	
#	8 21	L	+5	0		1 2	C	1 2 2A		
@	C 84	U	−3	0	1 2A 5	1 2		2 5		C
:	84 1	U	+2	0	1 2A	1 2	C	2		
>	842	U	−2	0	2A 5	1 2	C	1 2 5		
√	C 8421	U	+3	0	2A	1 2		1 2		C
?	CBA8 2	L	0	3	5			1 2 2A 5	1 2	C
A	BA 1	L	−5	3	1 2 2A 5		C	5	1 2	
B	BA 2	L	+1	3	2 2A		C	1	1 2	
C	CBA 21	L	−4	3	2 2A 5			1 5	1 2	C
D	BA 4	L	+2	3	1 2A		C	2	1 2	
E	CBA 4 1	L	−3	3	1 2A 5			2 5	1 2	C
F	CBA 42	L	+3	3	2A			1 2	1 2	C
G	BA 421	L	−2	3	2A 5		C	1 2 5	1 2	
H	BA8	L	−1	3	1 5		C	2 2A 5	1 2	
I	CBA8 1	L	+4	3	1			2 2A	1 2	C
!	B 8 2	L	0	2	5	1	C	1 2 2A 5	2	
J	CB]	L	−5	2	1 2 2A 5	1		5	2	C
K	CB 2	L	+1	2	2 2A	1		1	2	C
L	B 21	L	−4	2	2 2A 5	1	C	1 5	2	
M	CB 4	L	+2	2	1 2A	1		2	2	C
N	B 4 1	L	−3	2	1 2A 5	1	C	2 5	2	
O	B 42	L	+3	2	2A	1	C	1 2	2	
P	CB 421	L	−2	2	2A 5	1		1 2 5	2	C
Q	CB 8	L	−1	2	1 5	1		2 2A 5	2	C
R	B 8 1	L	+4	2	1	1	C	2 2A	2	
‡	A8 2	L	0	1	5	2	C	1 2 2A 5	1	
S	C A 2	L	+1	1	2 2A	2		1	1	C
T	A 21	L	−4	1	2 2A 5	2	C	1 5	1	
U	C A 4	L	+2	1	1 2A	2		2	1	C
V	A 4 1	L	−3	1	1 2A 5	2	C	2 5	1	
W	A 42	L	+3	1	2A	2	C	1 2	1	
X	C A 421	L	−2	1	2A 5	2		1 2 5	1	C
Y	C A8	L	−1	1	1 5	2		2 2A 5	1	C
Z	A8 1	L	+4	1	1	2	C	2 2A	1	
Ø	C 8 2	L	0	0	5	1 2		1 2 2A 5		C
1	1	L	−5	0	1 2 2A 5	1 2	C	5		
2	2	L	+1	0	2 2A	1 2	C	1		
3	C 21	L	−4	0	2 2A 5	1 2		1 5		C
4	4	L	+2	0	1 2A	1 2	C	2		
5	C 4 1	L	−3	0	1 2A 5	1 2		2 5		C
6	C 42	L	+3	0	2A	1 2		1 2		C
7	421	L	−2	0	2A 5	1 2	C	1 2 5		
8	8	L	−1	0	1 5	1 2	C	2 2A 5		
9	C 8 1	L	+4	0	1	1 2		2 2A		C
—		U	+5	0		1 2	C	1 2 2A		
<		U	+5	3			C	1 2 2A	1 2	

Figure 47. Printer Magnet—Contact Chart

Operation	Manual	Electrical	Feedback Contacts	Transmitting Contacts
1. Print	Letter Keys	R1, R2, R2A, R5 T1, T2 and Check	C2 (C1-used to sample outputs of contacts for error checking and transmission)	R1, R2, R2A, R5, T1, T2 and Check
2. Space	Space Bar	Space Magnet	C5	Space
3. Backspace	None	Bksp Magnet	C5	Not Used
4. Word Mark (Tab)	Word Mark Key	Not Used	C5	Word Mark (Tab)
5. Carrier Return	None	Car Ret Magnet	CR Interlock	Not Used
6. Shift	Shift Key	Upper Case Mag Lower Case Mag	C3 C4	Upper Case Lower Case
7. Keyboard Lock	None	Keylock Solenoid (energized to unlock keyboard)		Keyboard Locked Keyboard Unlocked
8. Index	None	Not Used (Occurs with every carrier return operation)	None	Not Used
9. Inquiry	Inquiry Keys	None	None	Inquiry

Figure 48. Key and Contact Summary

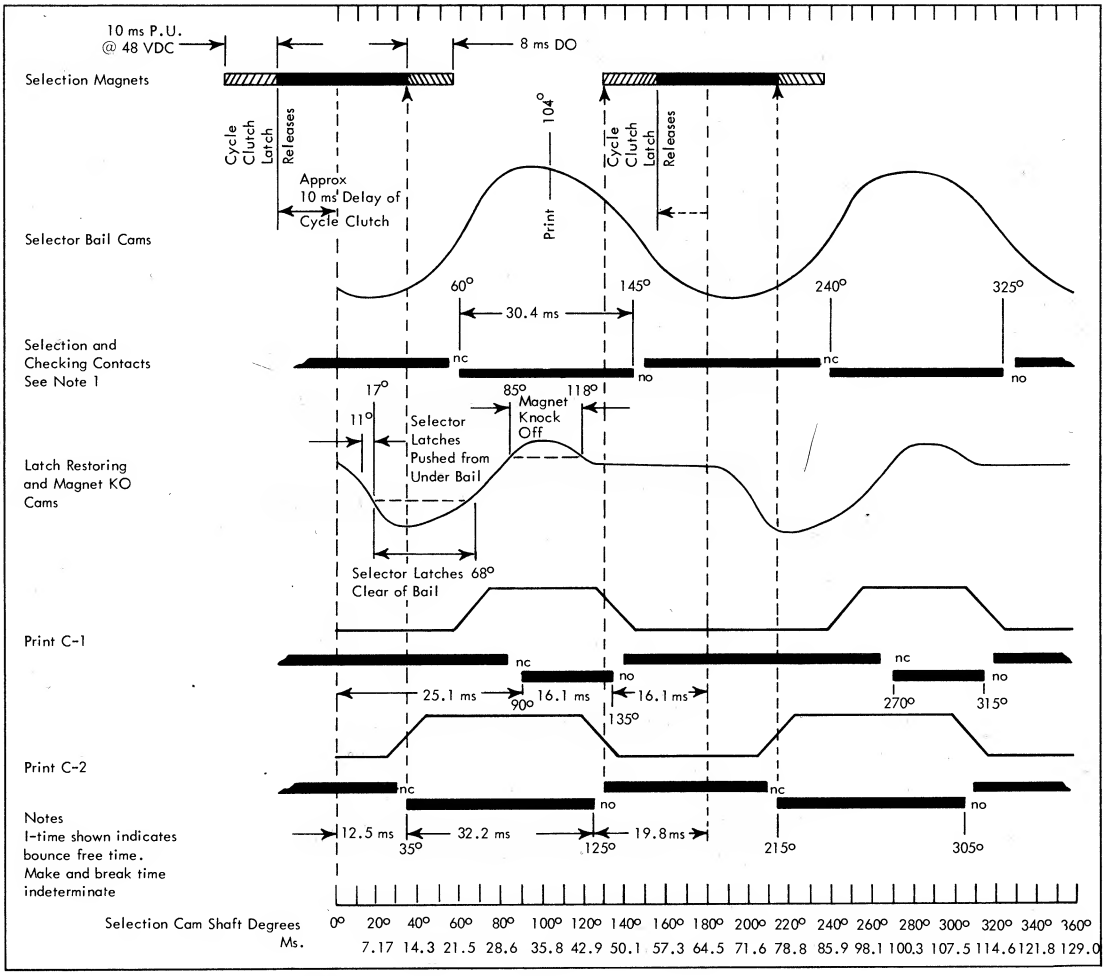


Figure 49. Print Selection Timing Chart

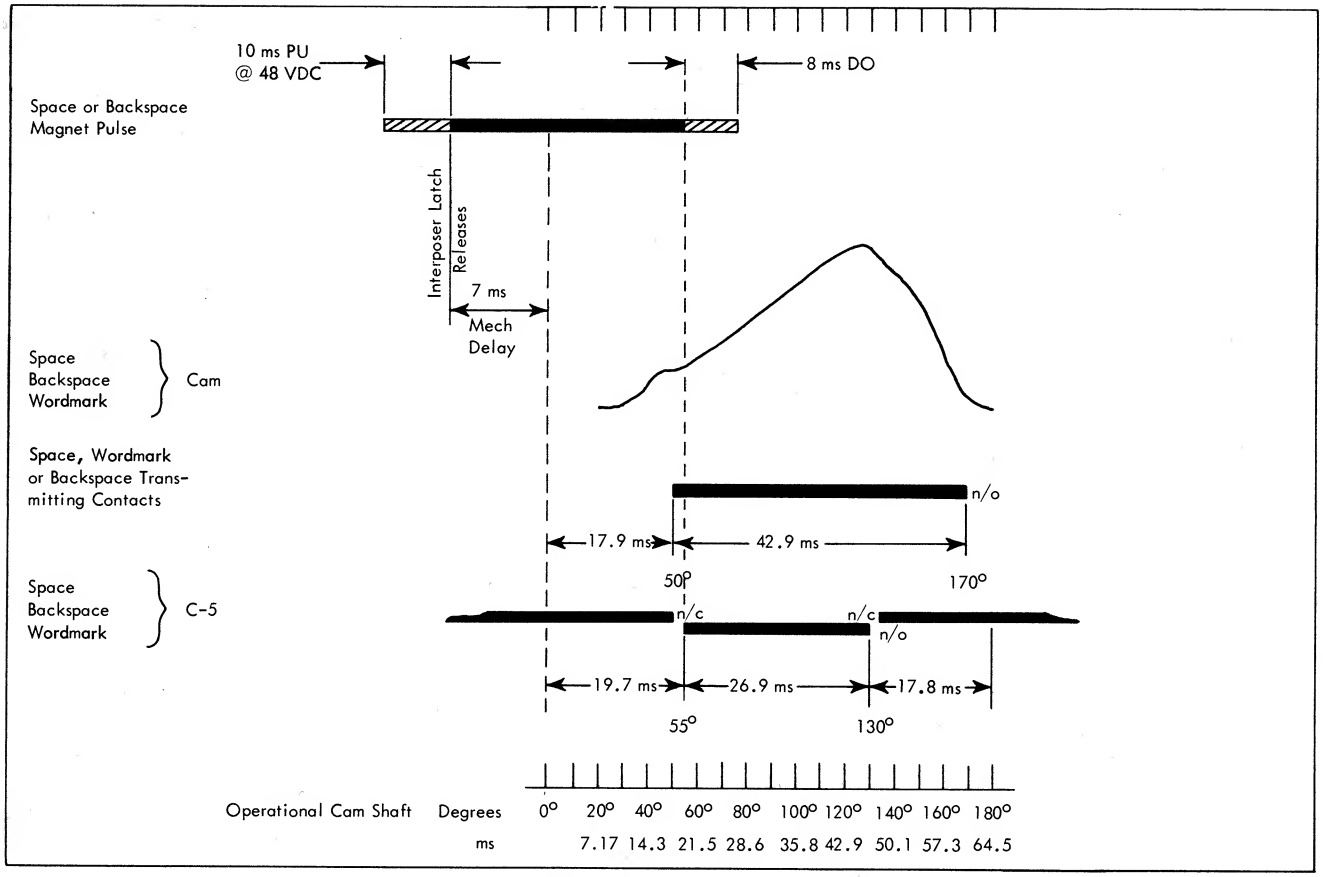


Figure 50. Space, Backspace Timing Chart

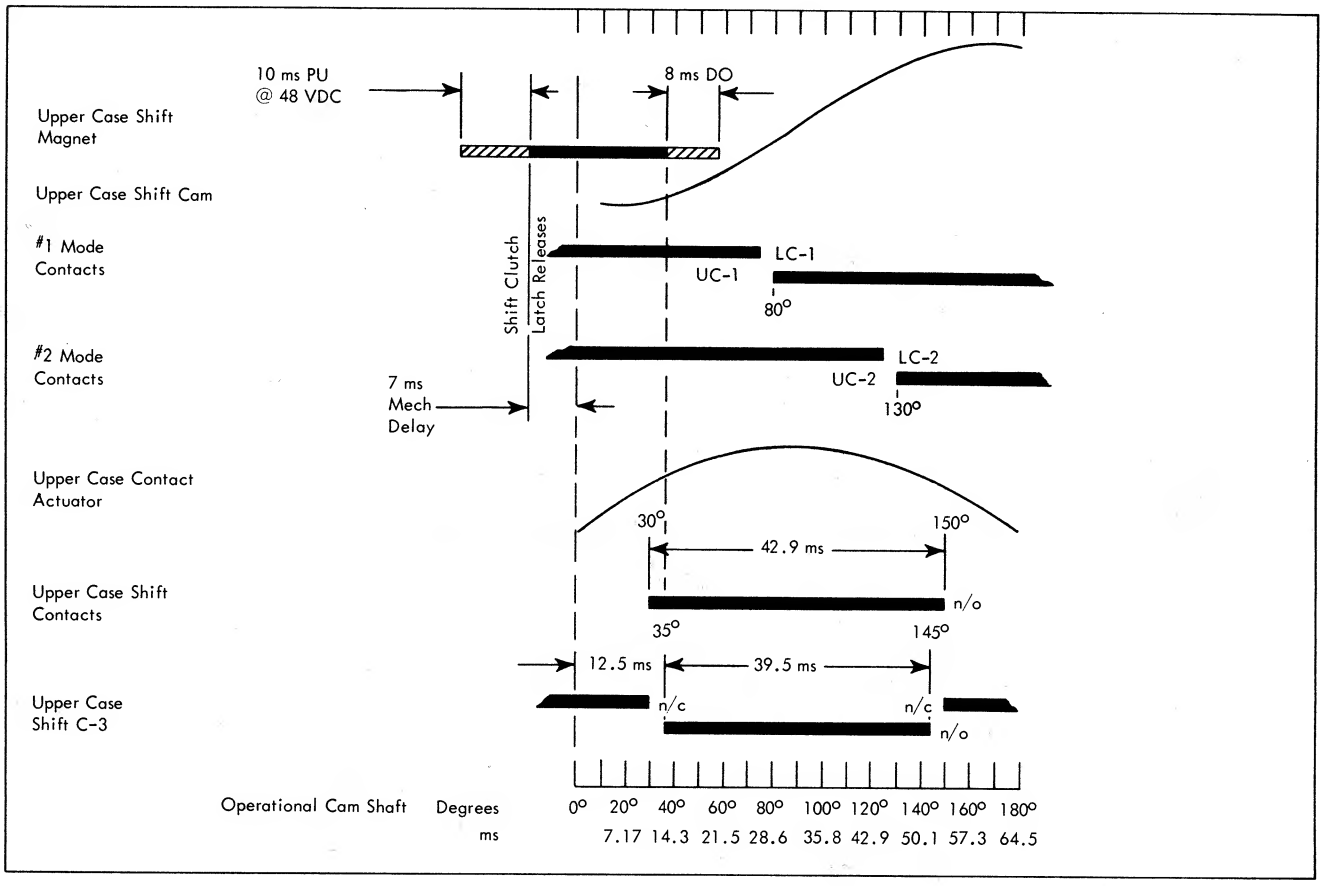


Figure 51. Upper Case Shift Timing Chart

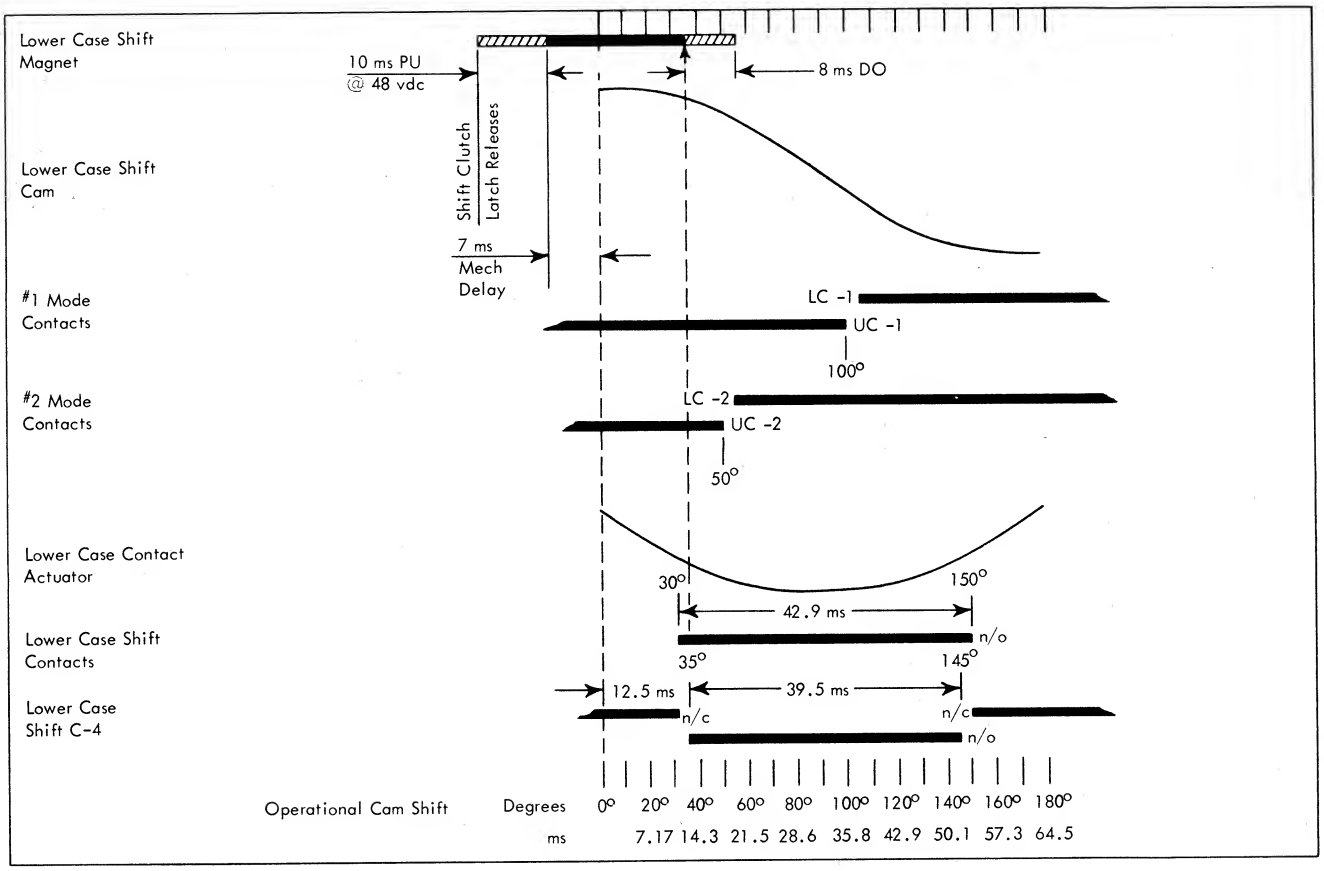


Figure 52. Lower Case Shift Timing Chart

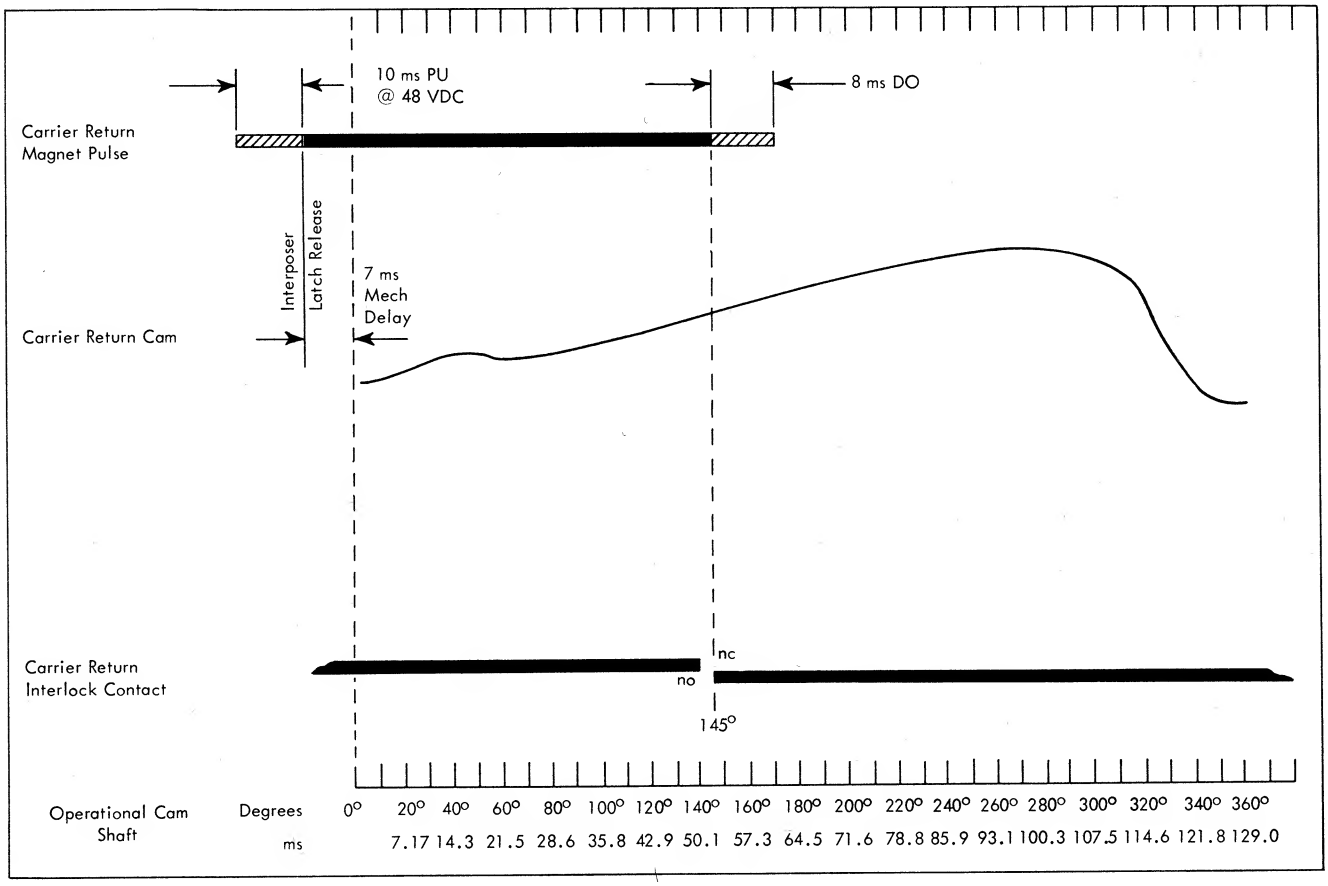


Figure 53. Carrier Return Timing Chart

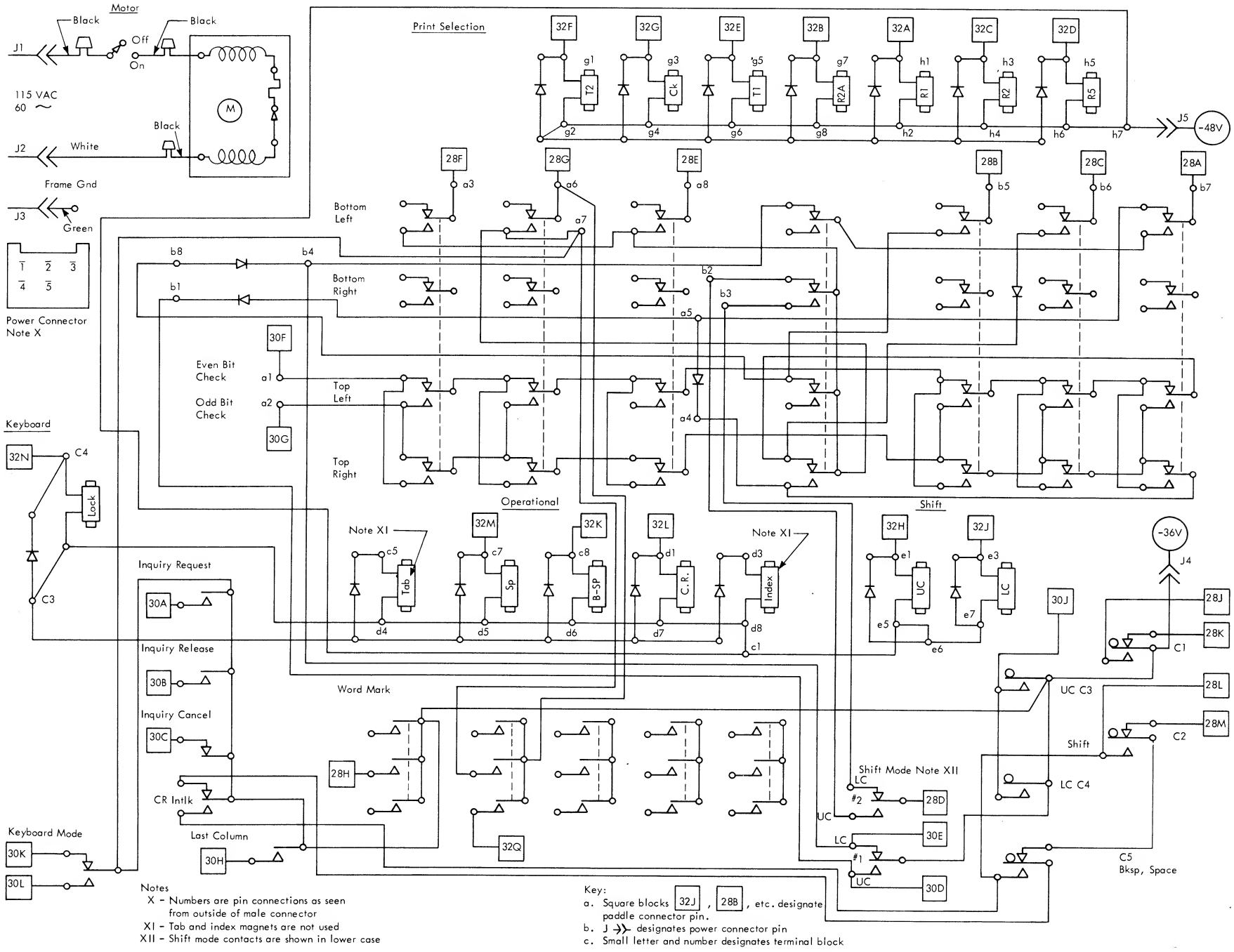


Figure 54. Printer Wiring Diagram

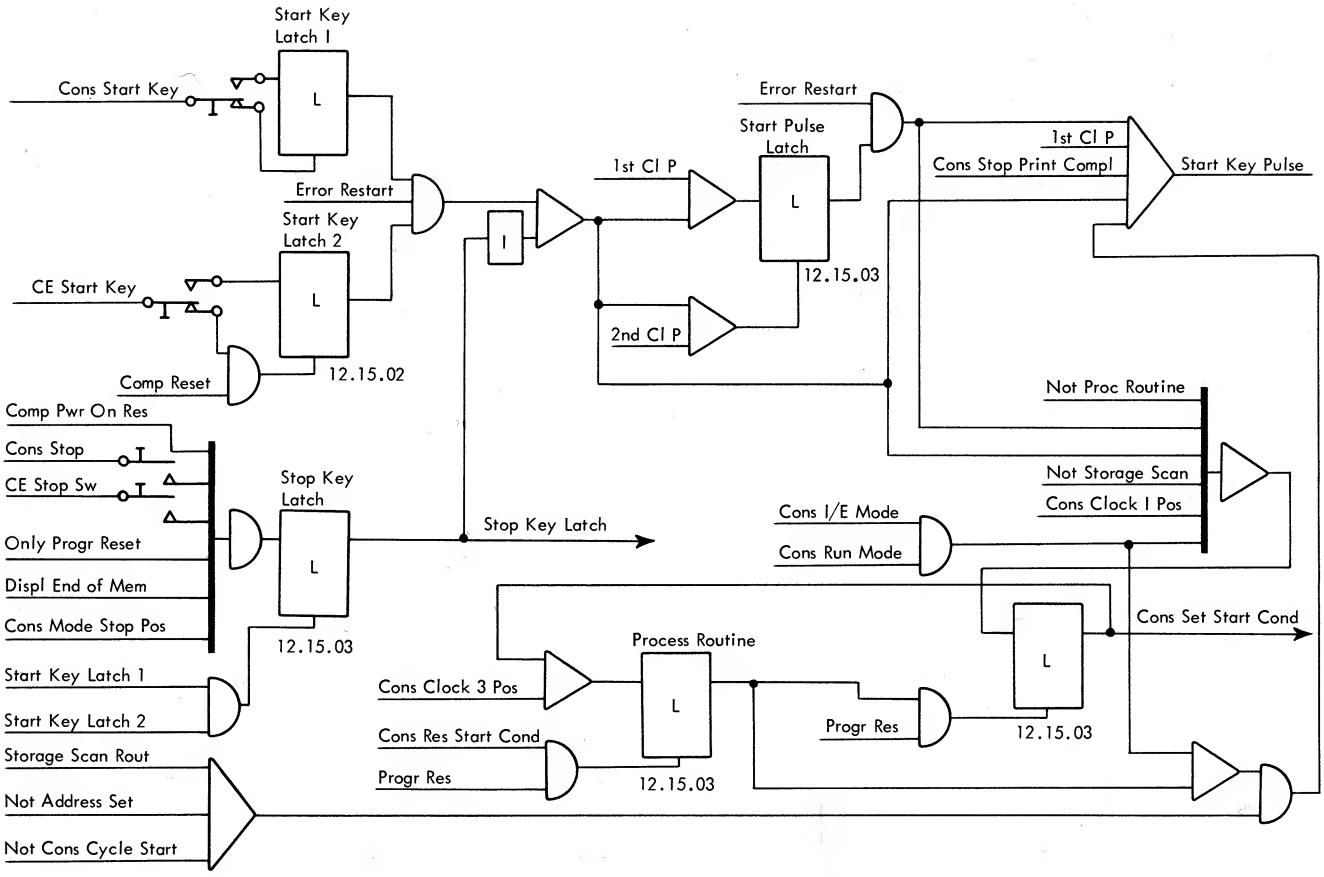


Figure 55. 1410 Start, Stop Pulse

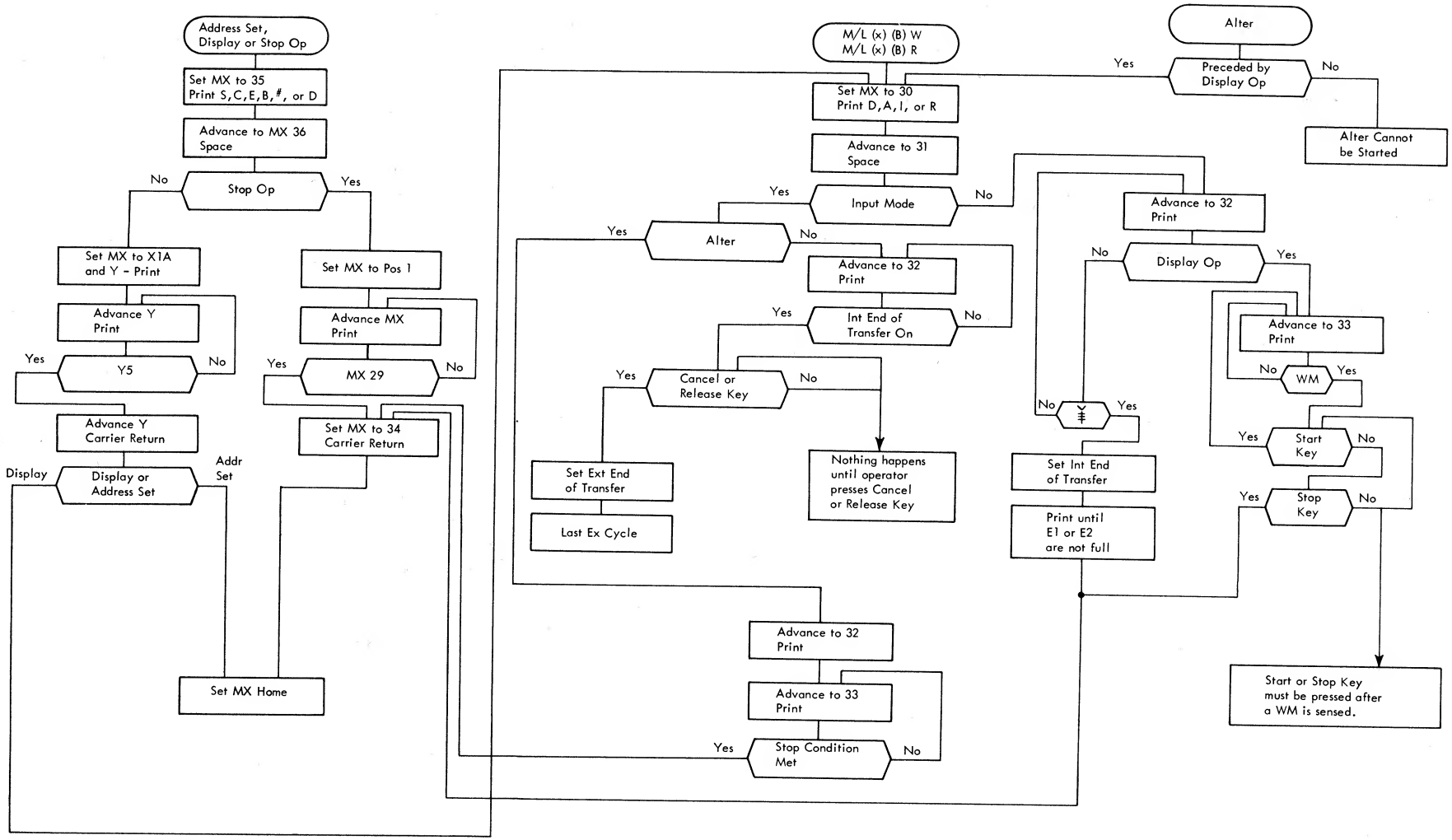


Figure 56. Console Matrix Logic

Answers to Review Questions

1. I-O printer output mode refers to the transfer of data from the CPU to the I-O printer. I-O printer input mode refers to the transfer of data from the I-O printer to the CPU.

2. T2, R2, R2A, and R5.

3. Next to last, end-of-line.

4. Space, backspace, word mark input, carrier return, index, and shift.

5. The console matrix provides gating for console operations and determines printing formats.

6. Seven X-triggers and six Y-triggers: X-1A, X-1, X-2, X-3, X-4, X-5, X-6, Y-1, Y-2, Y-3, Y-4, Y-5, and Y-6.

7. On output cycles they indicate the parity of the character being printed. On input cycles they transmit the keyed in data to the system.

8. a. Character control latch—used to print all characters on the typeball except the word mark and the underscore.
   b. Backspace control latch—used to control the backspace after a print WM cycle or preceding an error underscore cycle.
   c. Function control latch—required for space or carrier return operational cycles.
   d. WM control latch—used to set up a print WM cycle.
   e. Error control latch—used to set up an error underscore print cycle.

9. a. Solenoid driver strobe and character control.
   b. Solenoid driver strobe and word mark control.
   c. Solenoid driver strobe and error control.

10. 1.5 microseconds; from MX35 on at CC-2 to the next CC-4 when console printer not busy is reset.

11. An input word mark prints as a result of an output WM print cycle. Pressing the WM key causes the WM N/O contact to transfer and turn on the WM control and WM input latches. These in turn set up an output WM print cycle.

12. a. No rotate or tilt magnets are energized.
   b. The check magnet is energized (console assembly bits C, B, A, 8, 4, 2, 1).
   c. T1, T2, R1, R2, R2A.

13. a. Yes
   b. No

14. Print error character; backspace and shift, if necessary; underscore error character.

15. a. Odd
   b. Even (the word mark inverts the character's C bit in CPU).

16. The WM period latch on blocks the turn-on of the output error latch (45.50.11).

17. True

18. The backspace control latch brings up the shift complete line so that solenoid driver strobe can be turned on to gate the backspace magnet.

19. Console printer C3 or C4 N/O line active indicates a shift is in progress and blocks the shift complete line. This acts as a mechanical interlock between print cycles and the shift mechanism, if operating. (Broken tapes can result from C3 or C4 N/O failing to make).

20. Normal stop (S); cycle stop (C); error stop (E).

21. Identification character; IAR; AAR; BAR; op register; op modifier register; A data register; B channel; assembly channel; channel 1 unit select register; channel 1 unit number register; and (if two channel system) channel 2 unit select register; and channel 2 unit number register.

22. The position of the address entry switch selects the register.

23. To insure that the correct area of storage is altered. The display also provides a log record which can be referred to in case of operator error.

24. a. Console printer not busy latch.
   b. Console printer strobe.

25. B-channel, A-channel, assembly channel, and wrap-around conditions for address check (20K and larger memory).

26. The stop latch—clamps the clock pulse trigger. The stop latch is reset for each cycle needed as a result of console printer strobe.

27. When the displayed information contains no word marks.

28. The mode switch in the CE position activates the storage scan switch allowing storage scan operations to be performed.

29. The data enter the storage location specified by the B field address of the read console printer instruction.

30. a. The cancel key is used if a keying error is made while entering data.
   b. The E channel condition latch.

31. A branch on inquiry instruction and a console read instruction.

32. a. Yes, if a short or long entry is typed in.
    b. No, print cycles will continue through storage until a B channel GM-WM is sensed or memory wrap-around is reached.

33. Logic gate A is clamped and released as a result of "E Cycle Required." This is indirectly controlled by E channel strobe and console printer strobe.

34. Data check and busy.

35. The console read instruction is not executed and last execute cycle is brought up because the no transfer status latch is set.

36. —

COMMENT SHEET

IBM 1415 CONSOLE - MODEL 1

Customer Engineering Instruction - Reference, S223-2648

FROM

NAME _____

OFFICE NO. _____

FOLD

CHECK ONE OF THE COMMENTS AND EXPLAIN IN THE SPACE PROVIDED

FOLD

☐ SUGGESTED ADDITION (PAGE , TIMING CHART, DRAWING, PROCEDURE, ETC.)

☐ SUGGESTED DELETION (PAGE)

☐ ERROR (PAGE)

EXPLANATION

CUT ALONG LINE

FOLD

FOLD

NO POSTAGE NECESSARY IF MAILED IN U.S.A.

FOLD ON TWO LINES, STAPLE, AND MAIL

STAPLE

STAPLE

FOLD

FOLD

FIRST CLASS
PERMIT NO. 81

POUGHKEEPSIE, N. Y.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN U. S. A.

POSTAGE WILL BE PAID BY

IBM CORPORATION
P.O. BOX 390
POUGHKEEPSIE, N.Y.

ATTN: CE MANUALS, DEPARTMENT B96

CUT ALONG LINE

FOLD

FOLD

11/63:3M-EP-94

STAPLE

STAPLE

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